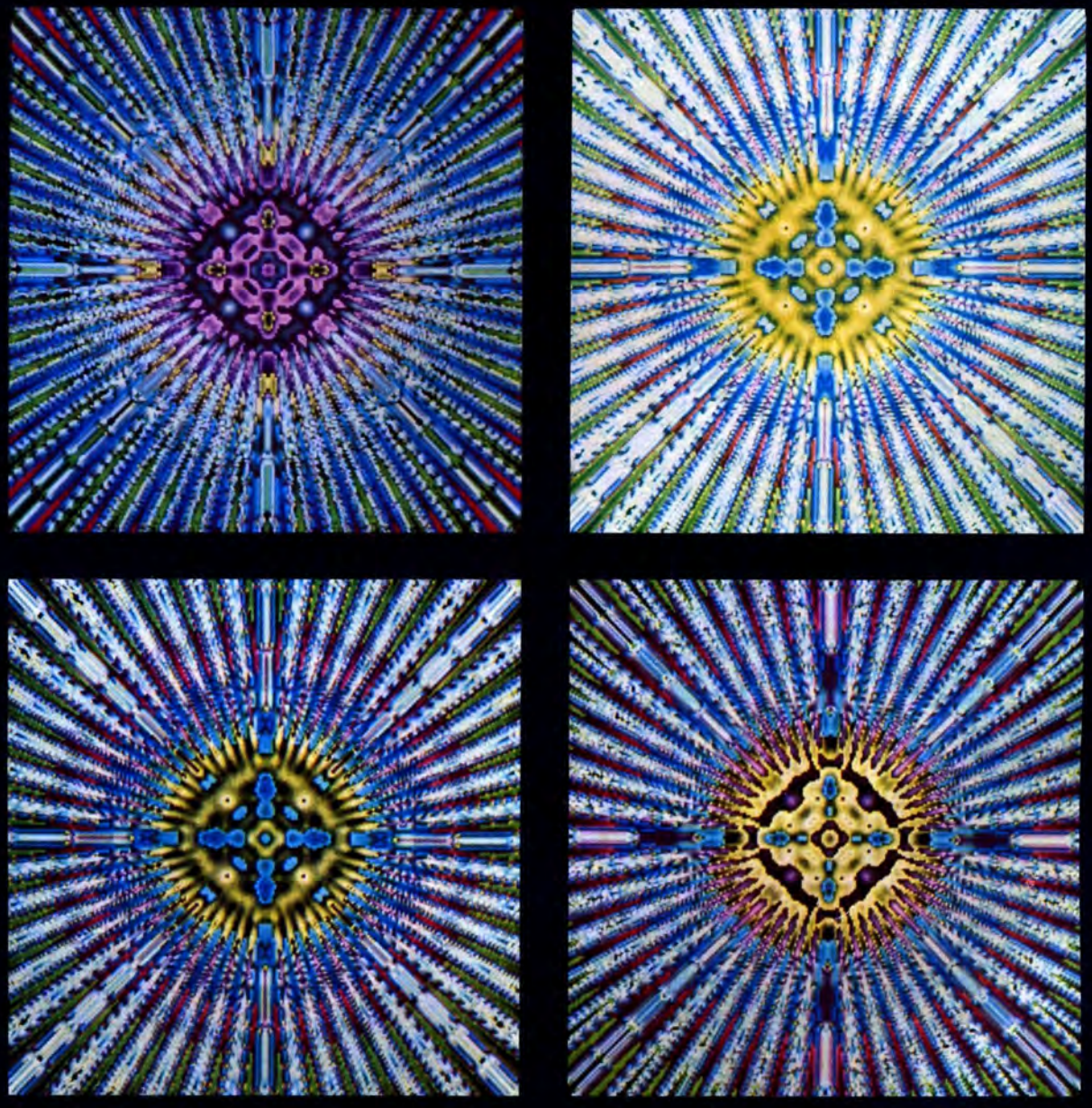
INTERFACE™

published for the home computerist/vol. 1, issue 9, august 1976 $1.50

color graphics—a beginning

microcomputer report card

BASIC—an easy programming language



SwTPC 6800 #1

IN PERFORMANCE

The word is getting around. There is simply no better processor available for general purpose computer work than the Motorola MC6800. This memory oriented processor is easier to program and makes possible more efficient, shorter and faster running programs than the old fashioned bus oriented processors. Have you been convinced that machine language, or assembler programs are only for the experts? Well not with a modern 6800 based computer. Anyone can learn very quickly with this simple straightforward hexidecimal notation processor. When you add to these advantages the unique programmable interfaces and the Mikbug® ROM you truly have a "benchmark" system.

Mikbug® eliminates the tedious and time consuming job of loading the bootstrap program from the switch console each time the computer is turned "On". With Mikbug® this is automatic and you simply don't have switches and status lights. It has been said (not by us) that a switch console is essential for "hardware development," (perhaps they meant "hardware debugging"). Anyway the SwTPC 6800 system has no need for either. This is a fully developed, reliable system with no strange habits. All boards have full buffering for solid noise immune operation. One crystal type clock oscillator drives everything, processor interfaces and all; so there are no adjustments and no problems.

FOR VALUE

The SwTPC 6800 in its basic form comes complete with everything you will need to operate the computer except an I/O device. This may be either a teletype of some kind, or a video terminal. You get a heavy duty annodized aluminum case, a 10 Amp power supply large enough to power a fully expanded system, a mother board with seven memory/processor slots and eight interface slots, a 2,048 word static memory and a serial control interface. This kit is now only $395.00. It was introduced at $450.00, but when processor prices went down we reduced the price of the kit accordingly.

As an owner of our 6800 computer you will get copies of our newsletter with helpful information and software listings. We have a library of software including all the common computer games and our fantastic BASIC. This is available to you for the cost of copying, you don't have to buy anything to get this material.

What more could you want? Pay a visit to our nearest dealer and see the 6800, plus our new cassette interface, graphics terminal and printer. He will be happy to demonstrate our system and to supply you with a 6800 that will fit your exact needs.

Mikbug® is a Motorola Trademark

SwTPC 6800 Computer System

with serial interface and 2,048 words of memory. $395.00

Southwest Technical Products Corp.
219 W. Rhapsody
San Antonio, Texas 78216

The Computer Store, 820 Broadway, Santa Monica, Calif. 90401, (213) 451-0713

Cyberdux, Microcomputer Applications, 1210 Santa Fe Dr., Encinitas, Calif. 92024 (714) 279-4189

The Micro Store, 634 South Central Expressway, Richardson, Texas 75080 (214) 231-4088

ELS Systems, 2209 N. Taylor Rd., Cleveland Heights, Ohio 44112 (216) 249-7820

Microcomputer Systems Inc., 144 S. Dale Mabry Ave., Tampa, Florida 33609, (813) 879-4301

William Electronics Supply, 1863 Woodbridge Ave., Edison, N.J. 08817 (201) 985-3700

Computer Mart of New York, Inc. 314 Fifth, New York, N.Y. 10001 (212) 279-1048

The Byte Shop Computer Store #1, 1063 El Camino Real, Mountain View, Calif. 94040, (415) 969-5464

The Byte Shop Computer Store #2, 3400 El Camino Real, Santa Clara, Calif. 95051, (408) 249-4221

A-VID Electronics Co., 1655 E. 28th Street, Long Beach, Calif. 90806 (213) 426-5526

Computer Warehouse Store, 584 Commonworth Ave., Boston, Massaschusetts 02215 (617) 261-1100

The Computer Workshop, Inc., 11308 Hounds Way, Rockville, Ind. 20852 (301) 468-0455

The Computer Store, Inc., 120 Cambridge Street, Burlington, Mass. 01803 (617) 272-8770

Marsh Data Systems, 5405 B. Southern Comfort Blvd., Tampa, Florida 33614 (813) 886-9890

Midwest Enterprises Inc., 815 Standish Ave., Westfield, New Jersey 07090 (212) 432-2066

The Milwaukee Computer Store, 6916 W. North Ave., Milwaukee, WI 53213 (414) 259-9140

Control Concepts, P.O. Box 272, Needham Heights, Mass. 02194

American Microprocessors, Equipment & Supply Corp. at Chicagoland Airport, P.O. Box 515, Prairie View, Illinois 60069 (312) 634-0076

The Computer Room Inc., 3938 Beau D'Rue Dr., Eagan, Minn. 55122, (612) 452-2567

Computerware, 830 First St., Encinitas, Calif. 92024 (714) 436-9119

Atlanta Computer Mart, 5091 B Buford Highway, Atlanta, Ga. 30340 (404) 321-4390

INTERFACE™

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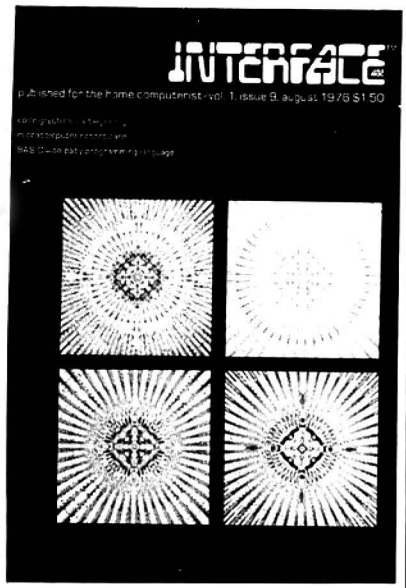

AUGUST COVER STORY

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As a whole, image processing is the analysis and enhancement of two dimensional data. The original data may be in such familiar forms as medical x-rays, weather satellite pictures, fingerprints, reconnaissance photographs, television or motion picture programming.

The cover is a portrayal of color enhancement using a single two dimensional design.

FEATURES

FEATURETTES

DEPARTMENTS

INTERFACE magazine, August 1976, Vol. 1, Number 9, published monthly by McPheters, Wolfe & Jones 6515 Sunset Blvd., Suite 202, Hollywood, Calif. 90028. Subscription rates: U.S. $10.00, Canada/Mexico $12.00, all other countries $18.00

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DIRECT ALL ADVERTISING INQUIRIES TO: Bruce Berkey, National Sales Manager, Advertising Department, INTERFACE magazine, 61 South Lake Avenue, P.O. Box 4566, Pasadena, California 91106—(213) 795-7002. Steve Richards, Advertising Representative; Zach Bovinette, Director, Retail Circulation.

INTERFACIAL

by *Sheila Clarke*

EDITORIAL

Listen, you guys! For months I've been sitting smack in the middle of a war between the hobbyists and manufacturers. It's a little like sitting at the net, watching a tennis game. I'm extremely fond of and want both sides to win. Since I'm in the middle, with something of an overview, allow me to referee for a minute.

A lot of complaints go out about late deliveries, imperfect chips, incomplete parts supplied with kits, circuit design errors and so on. Yes, we have an absolute right to expect what we're promised, and what we've paid for. But let's take a look, for a moment, at the other side.

Because a few had the nerve to strike out alone some time back, in order to bring micros into the hobby market at prices within reach of many checkbooks, those few have been playing the piper ever since. Some of these adventurers had never operated their own businesses before; and many of them worked for large, impersonal corporations. How were they to know that parts they'd designed into their circuit boards weren't going to be delivered to *them* on time? Most experiences have been a 6-8 week delay on chip orders. How did they know that after advertising a design that worked at the time, they would have to be recalled for updates? I suspect that at the beginning, when some manufacturers flooded the media with advertising, they never anticipated the large response, and weren't anywhere near ready to deliver the quantities ordered. Others of course needed to generate revenues to get into production, so further delays piled atop late parts from their suppliers. With inexperience added, everyone was hot under the collar.

There has been some relief from Uncle Sam's quarters, perhaps to some manufacturers' dismay. The FTC has imposed a ruling which demands that manufacturers respond to orders, paid in advance of shipment, within thirty days.

The Commission further demands that if shipment cannot be made as promised, all customers must be notified and be given a choice of either waiting or receiving a refund. Now, perhaps, the late delivery problem is a thing of the past.

"Yeh, but . . ." we protest, "what about all those other problems we've been having, once we finally *do* get our kits?" Not every product comes as promised, instructions and diagrams are not always possible to follow, and parts are sometimes damaged or missing. It's frustrating, but don't go away mad . . . continue to demonstrate. These frustrations are slowly being alleviated by intervening computer dealers. More and more computer stores are popping up all over the country, and one of their purposes is to relieve the manufacturer and hobbyist of these pressures by serving us directly.

Another difficulty we have stems from the manufacturers' lack of information at the outset; at what level of knowledge must we be to take full advantage of products offered? What we need, and should demand before buying, is each manufacturers' estimate of the necessary expertise. This information should appear in ad and sales literature.

However, no electronics kit manufacturer will assume the customer is totally ignorant of electronics. Kit makers assume the customer has a certain grasp of the *basics,* and justifiably so. That's what INTER—FACE, BYTE, POPULAR COM—PUTING, and other hobby publications are here for. It's important we hobbyists do our homework. The books that cover almost every aspect of home computing would fill a library. This magazine tells about a

BRANCH to . . . pg. 62

From the Publisher . . .

In order to permit the publisher the latitude to continue the creative expansion of this publication, it has been necessary to adjust our policy thus allowing growth free from external control.

It is for this reason that we have chosen not to associate this magazine or its future with any particular society or organization on an exclusive basis.

We look forward to the continued interchange among all computer interest groups and individuals through these pages.

Some of the articles in this issue have been contributed by the following members of the Southern California Computer Society.

Sheila Clarke	Larry Press
Scott Wilcox	Cliff Sparks
Tom Rugg	Bruce Scott
Phil Feldman	Art Childs
Mike Teener	Ralph Wells
Tom Gallant	S. A. Cochran, Jr.
William Donham, M.D.	M. Mallon
Ralph Klestadt	R. Edelman

Opinions expressed in these by-lined articles do not reflect or constitute endorsement by the Southern California Computer Society of this publication.

Addition of new and vital application and software oriented articles in hobbyist and business related subjects will be featured in forthcoming issues.

GENERAL MANAGER
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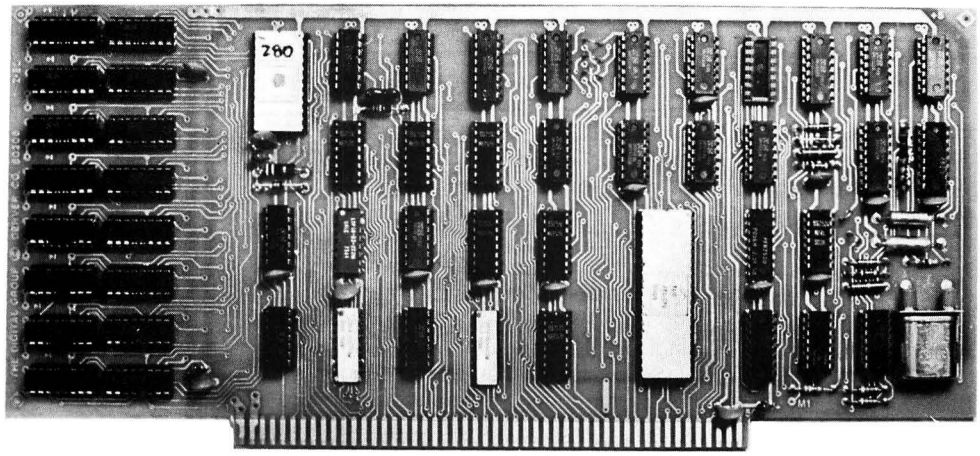
SUPER CHIP!

The Z-80 CPU by Zilog



From The Digital Group, of course.

If you are considering the purchase of an 8080-based system, look no further. The Z-80 has arrived. A new generation 8080 by the same individuals who helped design the original 8080 — combining all the advantages of the 6800, 6500 and 8080 into one fantastic little chip! And, the Z-80 maintains complete compatibility with 8080 software.

What's even better . . . the Z-80 is being brought to you by The Digital Group — people who understand quality and realize you expect the ultimate for your expenditure. With the Z-80, combined with the Digital Group System's video-based operation, you're at state of the art. There's no place better.

Take a look at some specifications:

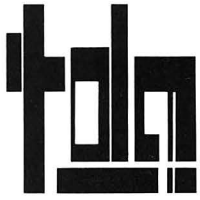
Z-80 FEATURES

- Complete compatibility with 8080A object code
- 80 new instructions for a total of 158
- 696 Op codes
- Extensive 16-bit arithmetic
- 3 Interrupt modes (incl 8080), mode 2 provides 128 interrupt vectors
- Built-in automatic dynamic memory refresh
- Eleven addressing modes including:
  - Immediate
  - Immediate extended
  - Page Zero
  - Relative
  - Extended
  - Indexed
  - Register
  - Implied
  - Register Indirect
  - Bit
  - Combination of above
- New Instructions (highlights):
  - Block move up to 64k bytes memory to memory
  - Block I/O up to 256 bytes to/from memory directly
  - String Search
  - Direct bit manipulation
- 22 Registers — 16 general purpose
- 1, 4, 8 and 16 bit operations

DIGITAL GROUP Z-80 CPU CARD

- 2k bytes 500ns static RAM
- 256 bytes EPROM bootstrap loader (1702A)
- 2 Direct Memory Access (DMA) channels
- Hardware Interrupt controller
  - Supports all 3 modes of interrupt
  - Mode 2 supports 128 interrupt vectors
- Data and Address bus lines drive 30 TTL loads
- Z-80 runs at maximum rated speed
- Single step or single instruction step
- EPROM de-selectable for full 64k RAM availability (programs may start at location Ø)
- Complete interchangeability with Digital Group 8080A, 6800 and 6500 CPUs

The Z-80 is here. And affordable. Prices for complete Digital Group systems with the Z-80 CPU start at $475. For more information, please call us or write. Now.



THE DIGITAL GROUP INC.

P.O. BOX 6528
DENVER, CO 80206
(303)861-1686

CIRCLE NO. 2 ON INQUIRY CARD

UPdate

SCCS AUGUST MEETING—August 28 at the Roger Young Auditorium, 936 Washington Blvd., in Los Angeles.

SEPTEMBER—Annual Meeting of Membership on September 25th. Cast your ballot for new officers and directors to direct the SCCS in its second year.

NEW GROUPS FORMING

PORTLAND—As yet unnamed, Steve Garrett has announced an interest in forming a microcomputer club in his area. Interested neighbors may contact him by writing 4203 S.E. Hawthorne, Portland, OR 97215.

SWT M6800 Users group is forming in Los Angeles. Contact Ed Keith at (213) 335-0521, ext. 313, or Rich Balding at (213) 320-4573.

RIVERSIDE—Kurt Cockrum would like to contact other SCCS members for a possible chapter in his area. Write him at 3398 Utah, Riverside CA 92507, or call (714) 682-1907.

BARSTOW, CA—People interested in joining this chapter of SCCS should write P.O. Box 1180, Barstow CA 92311.

LAKE OSWEGO, OR has its own club now. They're already into discussion of small business applications, text editing, I/O standard definitions and more. Contact club secretary John R. Lynch, 2105 S.W. Wembley Pk. Rd., Lake Oswego, OR 97034.

NORTH ORANGE COUNTY COMPUTER CLUB has formalized with by-laws and more than 55 paid members. Meetings are usually held the first Sunday of the month. Contact Patrick C. Powers, secretary, for more information at P.O. Box 3603, Orange, CA 92665, or call (714) 998-5831.

TEACHERS CHAPTER is just forming in the Los Angeles area, and first meeting was held July 27th. Next meeting is tentatively planned for August 24 at Granada Hills High School Computer Lab, 2:30. For more information, contact Conrad Gerrish at (213) 645-2304, or Tony Acampora at (213) 368-1711.

SINGLES CHAPTER? Here's the chance of a lifetime for gals who are into computers . . . apparently there aren't enough to satisfy the vast numbers of single (male) computer freaks. So Jerry Silver, instigator, has been posting ads like, "I am lonely, only have my micro to talk to . . . would like to meet partner of opposite sex. Exchange software, programs, hardware, at my processor or yours." Contact Jerry at (213) 877-7056 or 789-5873. Ladies heretofore uninterested in home computing may now find new motivation.

MICROPROCESSOR APPLICATIONS COMPETITION

"The First Annual Microprocessor Applications Competition," sponsored by Schweber Electronics of New York, is being held with the theme of making the world a better place to live. Judges will look for uniqueness of application, practicality of usage and efficiency in program structure. A grand prize of $1000, and four more cash prizes are being offered to winners. Schweber Electronics will provide contestants with entry kits that include systems concept, block diagram, listing of component parts, program source listing, and 50-word description of the project. Entry deadline is October 17, 1976. Winners will be announced November 17, 1976. Write Mr. Mel Kutzin, MPU Center for more information at Schweber Electronics Corp., Westbury, NY 11590.

GO TO YOUR LOCAL COMPUTER STORE . . .

That suggestion isn't as far fetched as it was 6 months ago! More stores are opening every month, and it's likely there's one within driving distance of your home. To name a few new ones . . .

THE DATA CENTER, 136 N. Maryland Ave., Glendale, Calif. (213) 243-0087. Specialty is used equipment, dealer for SPHERE Corp., and the usual hardware kit goodies.

THE COMPUTER CENTER, 8205 Ronson Rd., San Diego, Calif. (714) 292-5302. They're looking for game software and "gadgets" and will buy outright or pay royalties. They also supply stocked kits, and will help you plan your computer project and provide literature and advice.

EDWARDS ASSOCIATES adds a new line of NCR equipment including thermal-printing data terminal, keyboard send/receive terminal and portable keyboard send/receive terminal for two cassette recorders. The man to talk to is Allen J. Edwards in the California Federal Building, Palos Verdes, Calif.

DISCOUNT COMPUTERS—It appears that modern American merchandising methods and free enterprise have combined forces and are rushing to the computer hobbyists' rescue. It's a computer discount store called The I/O PORT, Box 296, Union City, CA 94587. The discount is 10%, and delivery is promised in less than a month. The selection appears to be limited to IMSAI equipment, but hopefully The I/O Port will expand their product line in the near future. They're asking us to tell them what we'd like to see developed, so now's your chance to really influence the computer hobby trend. Our suggestion: Make available some reasonably priced software! Good luck, I/O Port!

ALF PRODUCTS, INC., 2130 Bell Ct., Lakewood CO 80215 (303) 234-0871 offers programs in Basic for the HP 2000 series at 3¢ per page and $2 per paper tape, plus postage. They'd like to hear from you to know what you think should be included in the 8080 language they're now designing. Write to Phillip Tubb at ALF for a description of the language, and give your comments. Some of the HP 2000 programs available are LINK (a subroutine used in writing two-terminal programs), BATTLE (two-terminal ballistics game), CHESS, and STRTRK (two-terminal Star Trek game).

NCC RECOGNIZES THE COMPUTER HOBBYIST

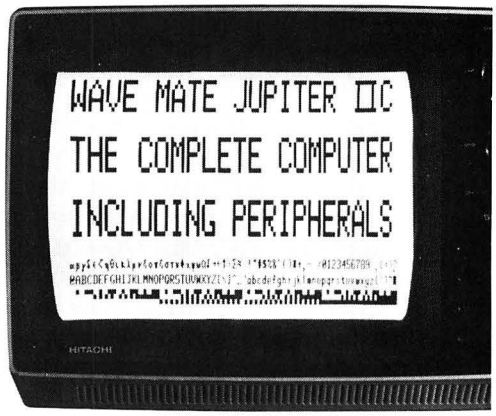
The National Computer Conference is one of the major events of the industry for manufacturers, data processors and general computer systems users. In the past, NCC has attracted only professionals. This will change in June, 1977, when the personal computing market will be recognized, discussed, and catered to at the Dallas convention.

Dr. Portia Isaacson, Chairman of the NCC 77 Convention Committee, has revealed plans for a special section of the show to be devoted exclusively to home computing and the hobbyist. To help enhance and implement these plans, Dr. Isaacson has requested personal computing clubs around the country to submit their ideas and suggestions about what the conference should provide.

BRANCH to . . . pg. 60

Now we're on TV!

Wave Mate introduces Jupiter IIC, a complete computer system incorporating a monitor quality TV interface. This system provides everything you need to create and run application programs. Jupiter IIC includes a CPU with 8K dynamic RAM and 3K ROM memory, video terminal interface and keyboard, and dual audio cassette tape interface. The TV interface features upper and lower case and Greek character sets, and dot graphics. The dual audio cassette interface provides start/stop operation and operates at 300, 600, or 1200 baud. And of course we still provide these high-quality features: burn-in tested IC's, socketed IC's, complete documentation, and more.



ATTENTION: ORIGINAL EQUIPMENT MANUFACTURERS

Jupiter IIC provides OEMs with the tools to get systems into the field faster and at lower cost. (1) Use Jupiter IIC as your development system. Perfect for development of software and special hardware. (2) Use Jupiter IIC for prototype systems. Only Wave Mate provides the tools – wire wrap modules, universal modules, complete documentation – to easily tailor system logic and add customized interfaces within the basic Jupiter IIC package.

SOFTWARE

All Jupiter IIC systems feature a sophisticated monitor/debugger package including a versatile interrupt system and I/O monitor call instructions. A programmable macro editor and expanded assembler are also provided. Proposed ANSI standard BASIC is included with Jupiter IIC.

THE JUPITER IIC KIT: $2200

The kit includes the CPU, software debugger and monitor module, 8K dynamic memory, module cage, power supply, front panel, video interface, cassette interface, and all the documentation required to assemble, run, and understand the system as well as modification instructions for a black and white TV set.

THE JUPITER IIC ASSEMBLED SYSTEM: $3200

All components of the Jupiter IIC kit plus two audio cassette units and a 12-inch black and white TV set. The complete system is shipped with all components assembled and tested.

SPECIFICATIONS

CPU
MC 6800; eight-level interrupt, prioritized and maskable by level; single-cycle and block DMA

DUAL AUDIO CASSETTE
Complete paper tape replacement; start/stop motor control; 300, 600, or 1200 baud (crystal controlled); error correction

VIDEO TERMINAL INTERFACE
64 x 16 lines (32 lines optional); Upper and lower case, plus Greek alphabet; 7 x 12 format, 128 dot (hor.) x 48 dot (vert.) graphics (96 dot optional)

MEMORY
8K dynamic RAM; 3K ROM; 1K dual-port static RAM

KEYBOARD
Generates full 128-character ASCII set

☐ Send details on Jupiter II systems
☐ Have salesman call
Name _____
Title _____
Company _____
Address _____
City _____ State _____ Zip _____
Phone _____

WAVE MATE 1015 West 190th Street, Gardena, California 90248 Telephone (213) 329-8941
Dept. 201

Wave Mate

"See us at Personal Computing '76, Shelburne Hotel, Atlantic City, August 28-29"

CIRCLE NO. 3 ON INQUIRY CARD

APPLICATIONS EXCHANGE

By Larry Press

COORDINATORS

BIOFEEDBACK: Larry Press, 128 Park Place, Venice, Ca. 90291 (213) 399-2083
BIORYTHMS: Art Childs, 335 N. Adams, #210, Glendale, Ca. 91206 (213) 243-5179
GAMES: George Tate, 3544 Dahlia Ave., Los Angeles, Ca. 90026 (213) 663-2604
MITS BASIC: Jon Walden, 11557 Sunshine Terrace, Studio City, Ca. 91604 (213) 769-6569
ELECTRONIC MUSIC: Prentiss Knowlton, 255 N. Madison Ave., Suite #4, Pasadena, Ca. 91101 (213), 449-6034
VOICE SYNTHESIS: D. Lloyd Rice, 821 Pacific, #4, Santa Monica, Ca. 90405 (213) 392-5230 (hm), (213) 825-2773 (bus).
ASTROLOGY AND ESP: Al Manning, ESP Laboratory, 7559 Santa Monica Blvd., Los Angeles, Ca. 90046 876-9984.
MARK-8 HARDWARE, CORRECTIONS, ADD-ONS, AND SOFTWARE: Ronald Carlson, 14014 Panay #255 Marina del Rey, Ca. 90291.

The list of applications coordinators is expanding. This month we are happy to welcome to the team two new members. Art Armstrong's specialty is computers in schools. If you're interested to know more, contact him at (213) 397-3847. His address is 3345 Moore St., Los Angeles, CA 90066.

Commodity and stock price prediction is being coordinated by Mary Stevens (213) 472-1098. Address is 11745 Montana Ave., #110, Los Angeles, CA 90049. Mary is interested in getting rich quick by programming models of commodity market behavior. I should think that anyone who's into forecasting (analysis of time series, moving averages, etc.) should keep in touch with Mary. For those in the L.A. area, she's planning a workshop on September 2nd and another on October 7th. The event, called "Commodity Futures/Computer Applications Workshops," happens the first Thursday of each month at Howard Johnson's, 1440 West Pacific Coast Hwy., Wilmington. The workshop includes facilitation and expansion of trading techniques by acquiring and sharing commodity computer programs. They will also undertake standardized programming language and arrays, perfecting flowcharting skills, maximizing timesharing costs, and exploring the possibility of acquiring their own data base. The first 20 people to attend the September 2nd workshop will receive complimentary copies of Mary's Oscillator in FORTRAN (WATFIV).

SCHOOLS

Art Armstrong teaches math and "Altair Exploration" at Venice High School. He began by bringing his own Altair to school, and last semester he taught a class in which ten students assembled a second Altair. He has worked out an assembly line process for putting kits together, and has a proposal to the L.A. City Schools to build a new computer every year. Once built, Art uses the machines in his math classes, and, of course, many of the students become hooked and learn BASIC and assembly language.

Art's project is extremely effective, and students are involved . . . they really like it. As a matter of fact, I met Art *after* meeting a group of his turned-on students. There is a lot of room for kit assembly projects in secondary schools, and if you are involved or interested in assembling or using a microprocessor-based machine in a school, stay in touch with Art. I've heard rumors of several school districts buying large numbers of kits and will try to run them down for next month's column.

If you've never thought much about computers in schools, but have a micro, why not drop by your local high school and show it off? For those who would like to get an idea of how schools use computers, I would recommend a subscription to People's Computer Company ($6), P.O. Box 310, Menlo Park, CA 94025. Or write to *Creative Computing* ($8), P.O. Box 789-M, Morristown, NJ 07960. You might also contact your local HP or DEC sales people, since both companies are deeply involved with computers in education. Next month, look for a list of projects in Applications Exchange which you might want to look into.

BIOFEEDBACK

The Palisades Amateur Radio Club, P.O. Box 2453, Culver City, CA 90230, will present a movie, talk and demonstration of biofeedback by Wayne Nail on October 17. Contact the club for time and location.

At the last SCCS meeting (May 22nd), a not-so-funny thing happened to a list of names and addresses of 35 people interested in biofeedback. Listed were people who had all sorts of things up and running on Altairs; people who were controlling art pieces using biofeedback, etc. If you signed that list, or even if you didn't, but are interested in biofeedback, please contact me. Write a brief statement of what you have done or plan to do, and enclose with a self-addressed, stamped envelope. In return, you will get a copy of the names and addresses, and a report on what others are doing. Be sure to indicate if you do not wish to share your name and address.

BIORHYTHM

Dr. Bill Donham is using an 8K BASIC version of biorhythm on his IMSAI, to chart some of his patients in an effort to better determine, and predict, their physical, emotional, and mental states of well being. He is currently carrying on a quasi-control study of several patients to determine if biofeedback has real validity (he believes it does) and to enhance and refine the initial program according to his findings. Look for his article discussing procedures and findings in this issue.

Paul Greene, 3547 Fairchild St., La Crescenta, CA 91214, has an Altair program to plot biorhythm charts. It requires 12K and is written in 8K BASIC.

BRANCH to . . . pg. 64

Rickey's tackling the SDK-80 microcomputer kit for his next science project.

Rickey likes soccer, lizards, hot fudge sundaes, skateboards and microscopes. He can't decide if he'd rather be Franco Harris, Bobby Fischer or Jonas Salk.

When his Dad brought home the Intel SDK-80 microcomputer systems kit, Rickey helped him put it together. It took only four hours. Everything was there. The 8080 CPU, RAM, PROM, programmable, I/O, a printed circuit board with all those capacitors and resistors and the other things that go with it. The best part was the instruction manuals. Every step was clearly explained. It was easy. The programming part looked especially interesting. So simple. Just imagine talking to a computer.

The big thrill came on Saturday when they went to his Dad's office to use a terminal. When they connected the SDK-80 to the teletypewriter they got a printout. That was exciting. Within an hour they were talking to the computer, then inventing games. They stayed all day.

Now Rickey is building a microcomputer of his own. He may be the first kid on his block with his own computer. Thanks to a $350 low interest loan from his Dad.

If you're interested in being the first on your block to have a microcomputer, contact your Intel distributor: Almac/Stroum, Component Specialties, Components Plus, Cramer, Elmar, Hamilton/Avnet, Industrial Components, Liberty, Pioneer, Sheridan, or L. A. Varah.

Microcomputers.
First from the beginning. intel®

3065 Bowers Ave., Santa Clara, California 95051.

CIRCLE NO. 4 ON INQUIRY CARD

Letters to the Editor

Dear Editor:

I am the president of a small company which manufactures automatic acoustic noise data acquisition and reduction equipment. It is our policy to provide the standard software required "free" by increasing the price of the data playback unit above its production cost in order to spread the cost of software over a number of users. Although this software is provided apparently free of charge, we consider this software ours and would respond with vigorous legal action if any of our competitors attempted to use it.

I am astonished at some of the concepts advanced in your May editorial. For example, if all software naturally belongs in the public domain, all professional programmers will immediately cease programming and begin new careers as fry cooks to support their families, since there is no means to obtain compensation for their efforts. I don't understand why you apparently feel that programmers are not entitled to an honest day's pay for an honest day's work. Do you also advocate that the physical products produced by machinists belong to the public?

You state that a manufacturer who gives away his software will naturally show greater profits than his competitors. This apparently means that if company *A* spends a substantial amount of money for software, and then places this software in the public domain so that companies *X*, *Y* and *Z* can provide equipment without the cost of software, that company *A* will show a higher profit than the other manufacturers who have a substantially lower development cost. I cannot follow the logic of this reasoning.

You mention that attempts to legislate morality always fail. In attempting to follow your logic as you develop this concept, I gather that since we are unable to prevent people from attempting to steal jewelry, the jewelry should either be thoroughly hidden by being cast in concrete, or the jewelry should be freely given to any passerby. While I agree that we have not been able to legislate out of existence thievery (or murder or rape), I feel that any and all such offenses should be prosecuted by the appropriate authorities. A thief is a person who takes something of value against the will of the owner. Someone who takes software without compensation is a thief by definition, unless the software is without value.

No publisher of a book would attempt to restrain the communication of the ideas embodied in the book. The publisher would, however, have every right to object should someone attempt to reproduce the book. Stealing software does not involve the transfer of some of the concepts involved in a software program; it involves the complete reproduction of all of the essential aspects of the software, including both the pattern of ones and zeros and the operating instructions.

You mention that you cannot take some of the comments of an author of the Altair Basic Interpreter seriously due to the tone of his letter. Assuming that the author has mortgage payments to make, and wife and kids to feed, I think that the circumstances would justify his attitude.

The final paragraph of your editorial suggests that a programmer whose software is stolen should ignore the matter and spend his time writing new software. Why would he spend any time writing new software if he were not properly compensated for his past efforts, and therefore had reason to believe that he would not be compensated for any future efforts?

Finally, you mention that he'll have a hell of a time catching all thieves. I agree, and a review of any police department's records will show that you are right. Despite this, I do support, and will continue to support, my local police department's efforts to apprehend and punish as many thieves as they can catch—INCLUDING software thieves.

Hal W. Hardenbergh
Santa Ana, CA 92705

Dear Hal:

Thank you for your fine rebuttal to our May editorial. We feel that both sides of the proprietary software controversy have been well represented, and would now like to lay the matter to rest. The truth of which is right and which is wrong probably lies somewhere in the gray middleground. No one, not even the President of the United States, would blatantly refute the laws laid down by Congress and supported by our courts. Neither can hobbyists be expected, or encouraged, to take proprietary software for personal financial gain. We will encourage, however, user libraries and free exchange of individually developed software for public domain for the sole purpose of furthering the hobby in one's own home and for one's individual pleasure.

Editor

Dear Editor:

Sincere congratulations on Richard Edelman's Basic Test Editor in the May INTERFACE. I've learned a lot from it, but could learn more if only he'd write a follow-up explaining the programming in detail.

Jim Callas
San Rafael, CA

Dear Jim:

Mr. Edelman says the follow-up would fill a book, so he's planning a series which handles specific aspects of the program. The first article will discuss string handling in detail, and is to appear in the September issue of INTERFACE.

Editor

Dear Editor:

Re your March 1976 cover: I took one look and assumed that the guy had axed his TTY because he discovered he'd just loaded a 16K monitor from paper tape to protected memory. Little did I know . . .

Tom Crawford
Santa Clara, CA 95051

Dear Editor:

I want to compliment you on the excellent job that's being done with INTERFACE. The January issue, which I received via MITS, contained two really useful programs—the tape I/O and the memory check. Later, I found the octal loader program useful, also. Then, the modification to the Altair Single Step and Examine Next circuit eased the load on those switches. Then the May issue came, and the article by Benson (on Serial Data Communications) just may save me having to buy a serial I/O board. Talk about getting your money's worth!

Gordon Berry
Lee's Summit, MO

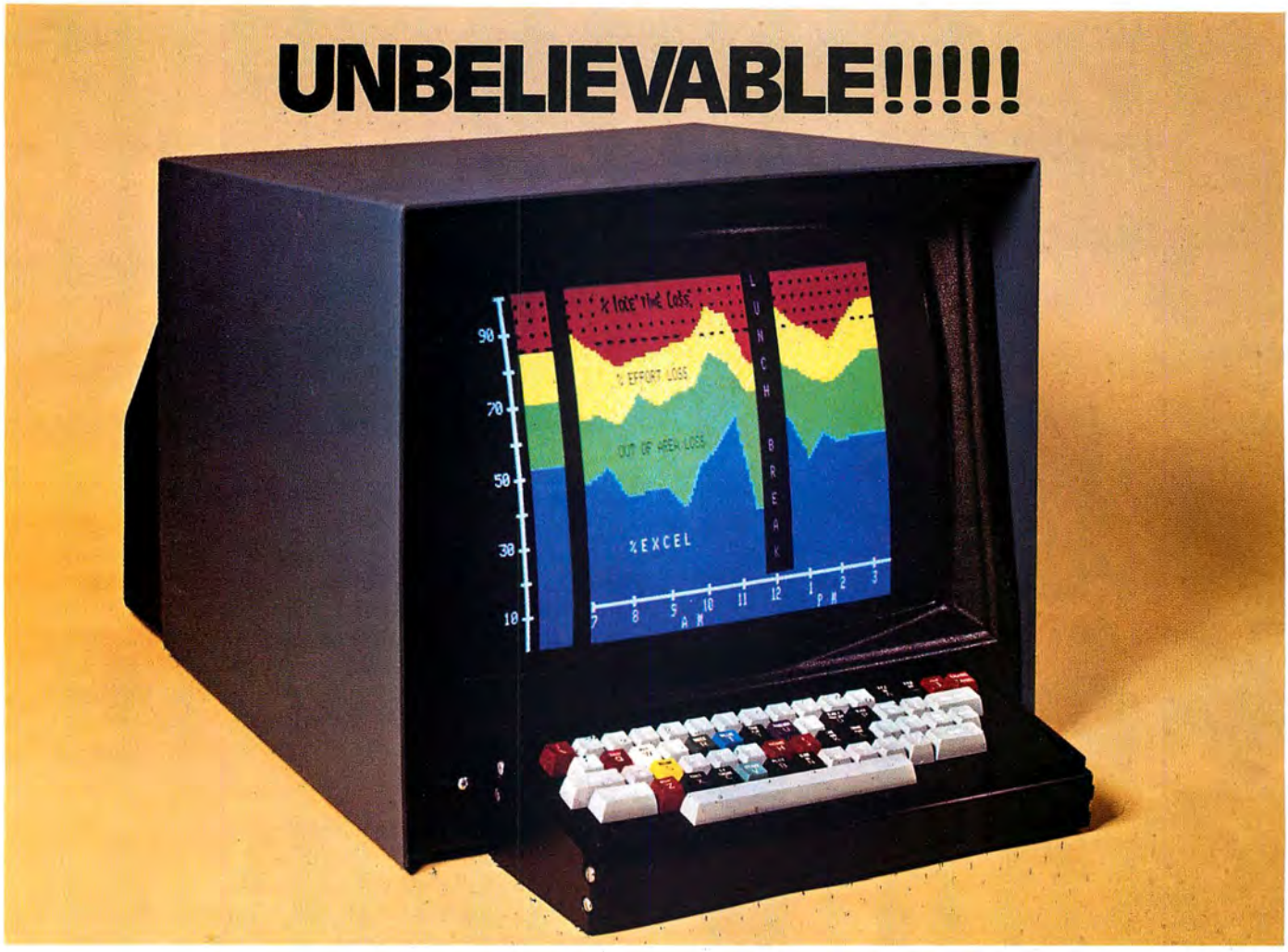
Dear Sir:

Two friends and myself purchased a surplus BIT 483 minicomputer 2 years ago. It has been quite an experience getting it running. I have written a monitor program for it and I am presently working on an interface for the BIT 483. I would be interested in hearing from anyone else working with a BIT machine.

I am also interested in an 8080 based microcomputer both as a processing system (such as the Altair) and as a basis for intelligent peripherals for the 483.

Ronald Derynck
#201 604 1 Ave., N.W.
Calgary, Alberta,
Canada T2N 0A3

UNBELIEVABLE!!!!!



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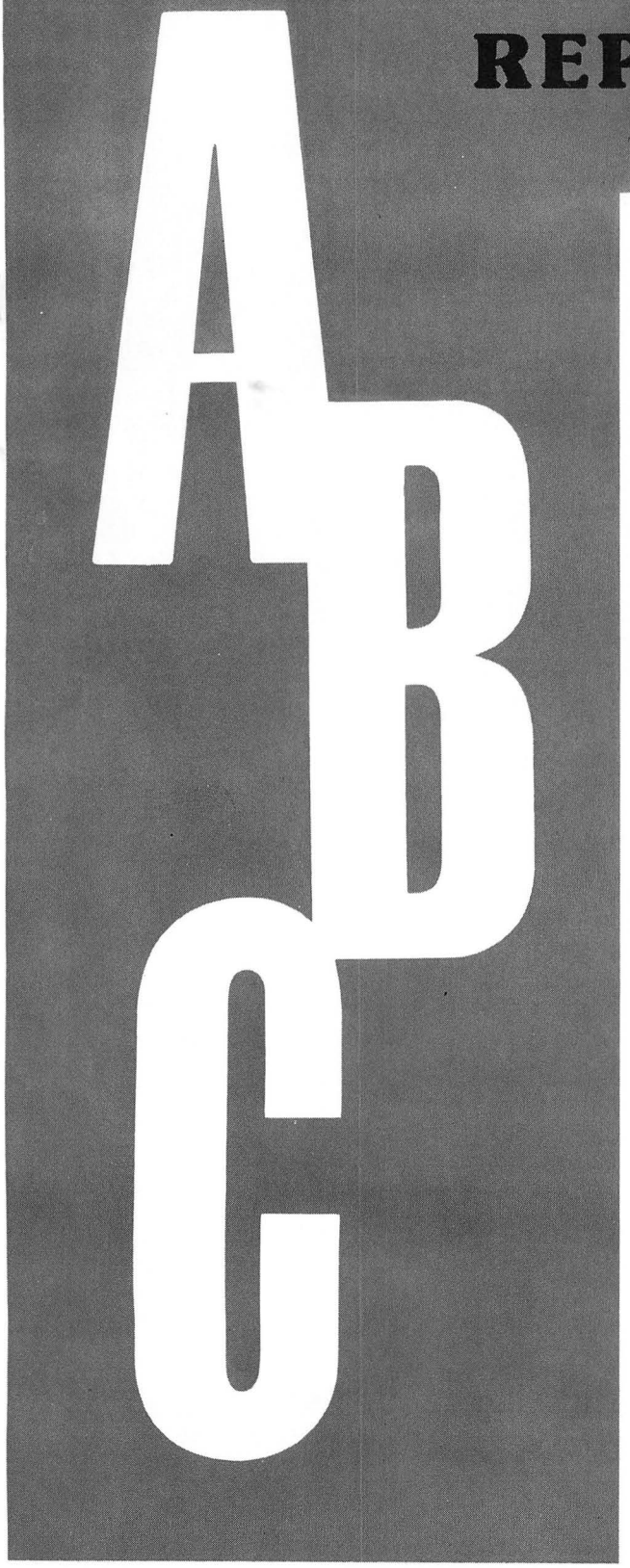


By Ralph Wells

A Vice President of Engineering for INMARCO (better known to Southern Californians as "Preview House"), Ralph Wells has researched many microcomputer kits on the market in an attempt to have small systems augment his unique business operation. A one-time physics instructor, Mr. Wells was a "tough grader," so he pulls no punches as he candidly describes his experiences and evaluates the famous, infamous and obscure computer kits.

Which microcomputer is best? Anyone interested in this "report card" should be spending a lot of time in his own pursuit of the best system. Most of the information available comes directly from the manufacturer or an acquaintance who bought, built, and who is defensive about the decision he made on the kit which he spent his money. Both sources of information have a built-in blinding bias. Computer clubs and hobby groups provide the best practical approach to getting one-on-one information about the popular kits, but what about the new, or not-so-popular entries? How can one get a fair evaluation?

This "report card" represents an attempt to provide comparisons based on one man's personal experiences. With the exception of DATA WORKS and KIM, the other seven microprocessor systems were purchased as kits and assembled on my living room table. I have personally debugged (or tried to), and evaluated each one in the laboratory at INMARCO. Currently I am using the DATA WORKS and SPHERE in limited commercial operation. The SOUTHWEST and IMSAI have bugs I haven't found yet, and the rest are up and running.

No attempt can be made to evaluate total system performance until bench-mark programs have been run on all systems—and that's a long way off, although the hardware, design, and basic firmware (pre-programmed ROMs or PROMs) can be commented on. No amount of tabular detailing could tell even the essential facts, so I've included a summary of the features and shortcomings of each system. Bear in mind that in all cases I was one of the early purchasers of each system, and most, if not all, of my negative experiences have been corrected by the manufacturers by

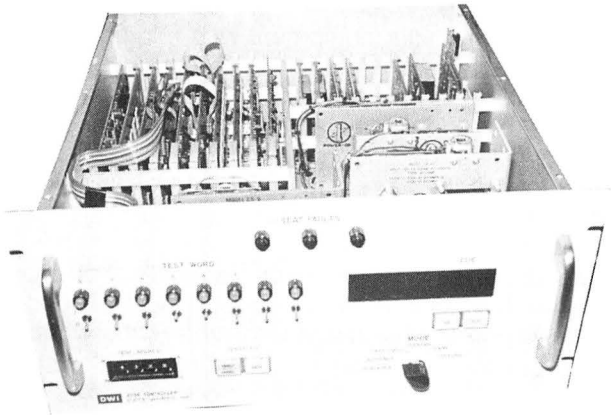
the time you read this. The descriptions are listed in the chronological order in which they were built. Incidentally, when I write 1KB, it means 1024 bytes (8192 bits).

DATAWORKS #2034 CONTROLLER—
8080 MICROPROCESSOR
Data Works, Inc.
9748 Cozy Croft, Chatsworth, CA

This system is more of a dedicated computer than a microprocessor. It has an impressive capability of I/O, but costs more than the rest put together. It entered the debugging phase in January 1975 (about the time the ALTAIR 8080 was announced) and accepts input from front panel switches, optical card reader, ½", 800 PBI, 9 track mag tape, TV cameras, and 256 analog inputs. It outputs EIA recordable video, LED panel display, 9 track tape, 12 chart recorders, CRT oscilloscope and several control lines. I have yet to hear of anything designed in 1974 which surpasses, or even equals its performance. The analog and video I/O were designed and built at INMARCO for in-house use at Preview House. DATA WORKS built the principle hardware and programmed the 6K of EPROMs.

The 4K RAM is additionally programmed by pre-printed, pre-punched, and hand marked IBM cards, while the Wanco tape deck is formatted and controlled by the 8080.

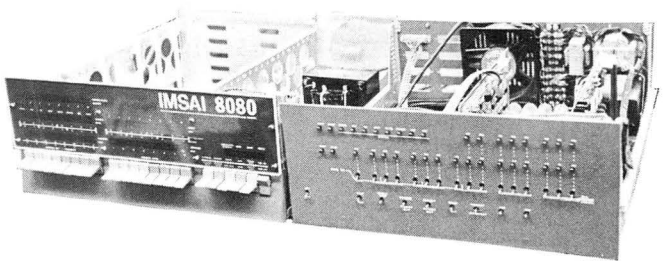
If your plans for the future go beyond Star Trek and Tic-Tac-Toe, DATA WORKS should be considered. This system is definitely not for the neophyte, and we are still waiting for software documentation. But it has the appearance of the professional computer it is, and really churns out data.



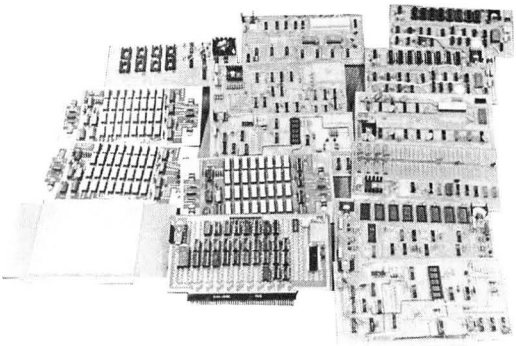
DATA WORKS. All front panel controls are for testing and setup only. All other I/Os via software using 260 inputs and 15 outputs.

ALTAIR 8800—8080 MICROPROCESSOR
(MITS, INC.)
2450 Alamo S.E.
Albuquerque, NM 87106

My ALTAIR system includes 8K RAM, PROM, TTY RS232, PIO, SIO, vectored interrupt, and real time clock. Frankly, I've encountered some delayed deliveries, octal programming (I prefer hex), and malfunctioning parts which slowed my progress, but it *was* the first



ALTAIR 8800 and IMSAI. Motherboard system which is common to the ALTAIR 8800 and IMSAI 8080 provide for the interchangability of the cards shown here. Cards were purchased from six different suppliers.



"affordable" computer and they originated the practical mother board design that has become an industry standard. Also, they've announced boards to expand the system in any direction you might want to go, and I'm waiting for the PROM programmer I ordered. I also have a Comter II which is supposed to eliminate front panel problems, but my version is a collection of modifications which I have yet to untangle, although I understand the 8800B has corrected most of these problems.

JOLT-MCS 6502 MICROPROCESSOR
Microcomputer Associates Inc.
10440 N. Tantau Ave., Cupertino, CA 95014

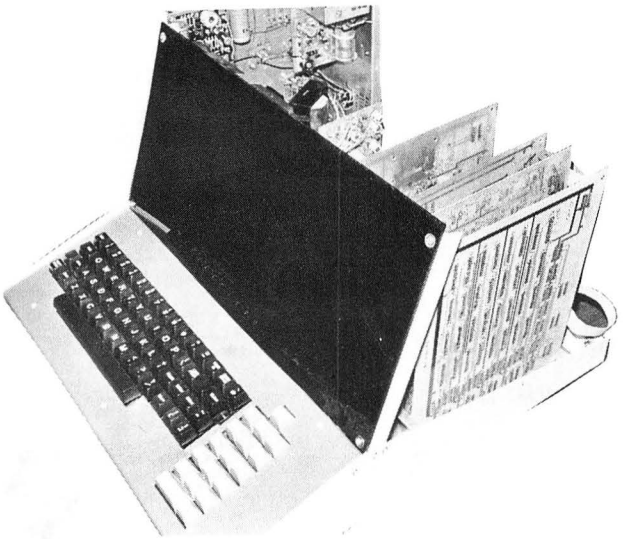
This little accumulation of wires and boards belies its outward appearance. If you stack up the boards, it is practically unserviceable, and ends up going through life strewn out on a bench looking very uncomputer-like, with *no* controls, switches or LEDs. However, when hooked up to a teletype it becomes a different story. The MOS technology interface chip uses a powerful 1KB, ROM (TIM or DEMON) to make it work like a computer. This approach of using firmware (PROMs) to replace the hardware indicates the real future in microprocessors, and JOLT was first. With the 5KB of RAM and two extra PIAs, it's been the most flexible experimental development and training system I've had in the lab. It has nearly 50 programmable I/O lines and outstanding software documentation.

SPHERE SYSTEM 2—6800 MICROPROCESSOR
Sphere Corporation
940 No. 400 East
North Salt Lake, UT 84054

My SPHERE (one of the first) is the one I show to

people, as it looks and works like people think a computer should. After replacing the keyboard, most of the power pack, and redesigning its circuits to fulfill my special requirements, it is being used in an experimental project to generate video tapes. For my money (and it *was* my money) the SPHERE is the best route for the serious software-oriented enthusiast.

Implementation of the grand concept described in the sales promotions leaves a lot to be desired, but they're making headway on the hardware, software and component problems. No other system has in integration of TV, TTY, cassette, keyboard, modem and



SPHERE—Features integrated combination of keyboard, video, teletype, cassette, and modem I/O with power supply.

general purpose I/O. DATA WORKS and ALTAIR-IMSAI can put it together with plug-ins, although they lack the firmware cohesion provided by SPHERE. My TV display has been modified to produce three sizes of "type," variable line spacing with EIA sync and "20 line" pages. I found the documentation to be almost undecipherable, and have yet to get the mini-assembler and debugging routines to work. Others have had more success, so there's hope. The SCCS Sphere user's group has been instrumental in my understanding of the SPHERE instructions, debugging the hardware, and the utilizing EPROM capability. The 5KB+ of EPROM is second only to DATA WORKS.

For more about getting the SPHERE system up, read Warren Wiemer's article in May INTERFACE, "Up 'N Runnin'."

SOUTHWEST TECHNICAL PRODUCTS CORP.—
SWT 6800
219 W. Rhapsody
San Antonio, TX 78216

This is really a two part system consisting of an uncased (but fully operational) TV typewriter feeding a video monitor, and a not-yet-debugged microcomputer. The SWTP has only pilot light, power and reset switches as standard equipment, so you really need the TVT or teletype. Like the JOLT, it uses a ROM (MIKBUG)

SWTP 6800—Combined with the uncased TVT, it has lots of motherboard space for as-yet unavailable I/O expansion.

to replace a lot of hardware, and provides a minimal operating system. SWTP designs are still discrete hardware oriented, with sparse selection of plug-in adapter boards to compete with the ALTAIR approach. SWTP has been active in the hobbyist kit business longer than anyone, and can probably be counted on to overcome any shortcomings to become a really cost-effective leader in the long run.

IMSAI 8080
IMS Associates, Inc.
1922 Republic Ave., San Leandro, CA 94577

Delinquent delivery and parts shortages delayed completion of this system, and since it seems to be an improved version of the up and running ALTAIR, there's been little incentive to provide the required debugging time. When I first turned it on, it smoked. If I retro-fit my older equipment with microprocessors, it will probably be IMSAI.

It doesn't really *do* anything much different than the ALTAIR, but it *looks* like a piece of professional equipment and has the only really adequate power supply of the lot. All the aforementioned ALTAIR type boards should function just as well in the IMSAI, and this is where IMSAI really has the advantage. It has the versatility of a wide range of "standard' I/O boards, and the best box in which to put them. The documentation on the hardware was among the worst I've seen, but the appearance of the resulting system—the best of any.

MOS TECHNOLOGY—KIM MCS 6502
MOS Technology, Inc.
Valley Forge Corporate Ctr.
950 Rittenhouse Road, Norristown, PA 19401

The KIM is not a kit, but by the time you've built and connected power supplies, interfaced it with a TTY, audio recorders, change-over switches and I/O experiments, you loose sight of that. In my opinion, this is the dark horse to watch in the race for the amateur computer buff's dollar. On one card, it surpasses in performance all ALTAIR cards I've built, except the RAM, EPROM, and power supply. A removable or paralleled keyboard replaces the lever switch binary coding of the ALTAIR and IMSAI, and

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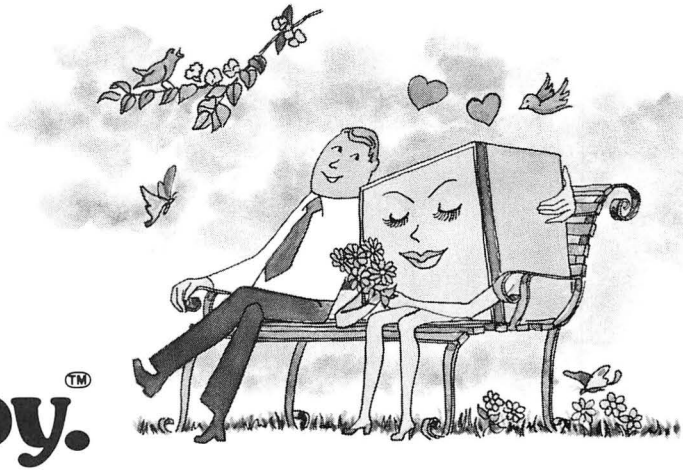

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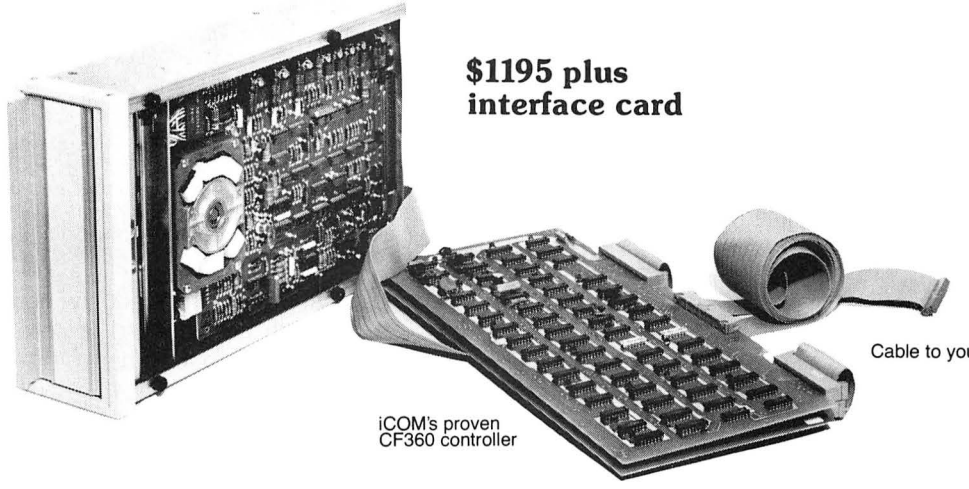

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does it directly in hexadecimal.

MOS Technology goofed on the TTY interface by using only 5 volts for the 20 milliamp loop. Even my brand new TTY wouldn't give consistent results, but increasing the voltage fixes this up. Now I have an even more reliable TTY interface, and software control of the tape read-write, as well as a TTY mini-operating system, with about the same features as its predecessor, the JOLT. The KIM uses twice as much firmware power as the TIM (DEMON) used in the JOLT, most of this extra firmware going into its cassette/telephone audio-digital recording system. They goofed again here by not resetting the BCD conversion status, so it must be done immediately after turn-on, or you start off your first experiment with problems.

The recording technique doesn't match K.C. (Kansas City) standard, Tarbell, or any other—but it really works. No reasonable machine or tape defect could make it fail—and when I did fault it, it dutifully informed me thereof. The use of seven segment, 6 digit readout in hex to replace the blinking LEDs on the DATA WORKS, ALTAIR and IMSAI spoiled me completely. I'm seriously considering redesigning them for this system. The programmable I/Os have lots of help from KIM's firmware subroutine, and together with two crystal controlled timers, opens up a whole new world for the electronic experimenter. The software buff will get a kick out of the 13 addressing modes and the well documented subroutines available in KIM's 2KB ROM.

When you compare the circuit complexity and number of chips of the KIM board to any single I/O board of an ALTAIR, you've got to be impressed with the cost-effectiveness of replacing hardware with ROM. MOS Technology has made a long leap ahead of the pack and cinched it up by providing the best documentation—bar none. Most software documentation is written by and for programmers (who probably don't need it anyway), and the rest of us spend hours trying to decode vague (and sometimes incorrect) descriptions. Not so with KIM. Sure, they made the usual mistakes—but they didn't take months to discover them. The new corrected manual is already off the press, and when you get through reading all three books supplied, you know more about the MCS 6201 and Motorlola 6800 than you could get from SPHERE, SWTP or Motorola. What's more, you can turn the operation manual over to somebody else, and in a remarkably short time, they're running the KIM, gleefully storing what they've done on cassette.

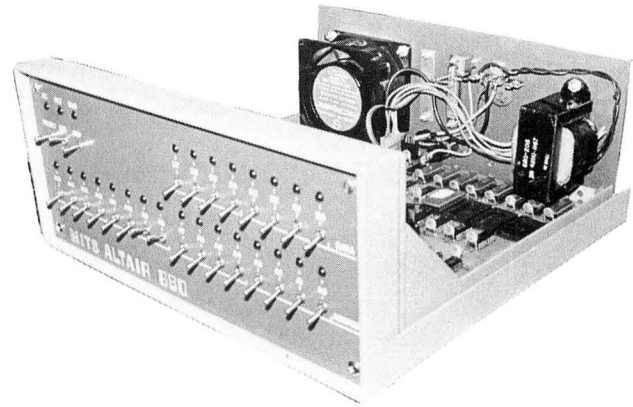
Before you write out that $250 check—consider this: Its expansion is currently limited. It has 1KB of on-board RAM, and no EPROM. The busses and controls are effectively available on standard sockets, but will have to be buffered, and there are timing problems when using available and affordable memory chips.

Also, there are no standard boards available as yet, for either RAM or EPROM. MOS Technology is bringing out a 4KB RAM at $179, and an 8KB for $298. They also have plans for a buffered mother board to support an ambitious assembler and Tiny Basic in masked ROM. This would put them up with SPHERE, who also offers a resident editor-assembler-utility EROM.

ALTAIR 680 (MITS, INC.)

If this little beauty didn't have "ALTAIR" printed on the front panel, I wouldn't have known it came from the same company that produced the ALTAIR 8080. About the only negative thing it has in common with its big brother is initially slow delivery and a couple of minor component problems.

I haven't had time to run it through all its paces yet, but the engineering quality is head-and-shoulders



ALTAIR 680—The PROM supplied with the 680 allows use of TTY to eliminate dependence on front panel switches. It's the smallest and most recent packaged system at about one-third the size of its big brother, ALTAIR 8800.

above anything I've previously bought from MITS. It packs most of the standard features of the 8800 into ¼ the volume, and still has empty EPROM sockets and on-board TTY (ASR or BAUDOT), or RS232 I/O. The 680 uses EPROM for hardware trade-off in the TTY circuit. It's not as nearly effective as on the KIM, but it does make the front panel switches almost redundant. Memory and accessory expansion are problems, though not as severe as KIM's. I don't see how I'm going to be able to plug my Tarbell Cassette Interface or Bytesaver (Cromemco) into this unit, but MITS has announced a 16KB memory expansion is forthcoming.

SC/MP
National Semiconductor Corp.

Most people call it SCAMP. This little rascal is the latest addition to the Ralph Wells family of microprocessors. It's truly the "baby," being small (will fit easily into a coat pocket) and unique in many ways. To start with, it was delivered on time! The SCAMP also *worked,* with *no* debugging required, the first time it was plugged into the TTY. What with design errors, instruction errors, component failure, software errors, etc., on the parts of suppliers (including the "assembled" KIM), and on my part, an extra dose of carelessness, ignorance, and downright stupidity, I had never had a computer work the first time until now, including those I'd designed myself. The SCAMP arrived at noon and was built, interfaced and successfully checked out before 5:00. The board is less than 5" square. The entire kit comes as an 8½" x 11" "page" in the manual. The active components take up only half the area and the rest is for experimenting. "Half" sort of typifies the SCAMP. It has ½ KB ROM,

sells for ½ the usual price ($100) and has half the instruction set of the aforementioned microprocessors. It also has an abbreviated address bus, and only ¼ KB RAM. Unfortunately, I'm afraid the SCAMP will be the runt of the litter. It's sold as an "evaluation kit," but is something more.

The SCAMP was obviously not designed to be a general purpose microprocessor like the 8080, or its own big brother, PACE. It was apparently intended to be used as a building block to provide inexpensive ($17.76 for the CPU) "artificial intelligence" for the next generation of sophisticated electronic devices. If expansion was a problem for the KIM and 680, it is a veritable road-block for the SCAMP. Once you get past 4KB (12 address lines), you have to resort to time-division-multiplexing a la the old 4004. The status word has been completely reworked, and nearly all the conditional branches are eliminated. The only tests are for "0" accumulator—3 instructions. This and other instruction limitations make machine language tedious, inefficient, and thoroughly frustrating; an experience reminiscent of the old 4004 days. With the limited addressing, it's doubtful whether a BASIC program would ever be practical for SCAMP.

Higher level programming is desirable, but is only practical with the use of time sharing or cross-assembly. At $500 for cross-assembler software (even more for time share), neither approach has been within my reach financially, although I have limited access to a big Burroughs.

Why did I buy it? Sooner or later, even the most avid "Game of Life" player and "Dazzler" watcher is going to get tired of games and find practical applications for artificial intelligence in the world around him. When that happens, he may well "SCAMPer" on down to National Semiconductor's nearest dealer. Most simple, and not-so-simple, applications require sensing an on/off condition and controlling on/off devices—usually involving "time." Here's where the runt of the litter walks ten feet tall. The SCAMP can read three, and write four lines directly from accumulator to TTL levels without interface. In addition, it features the widest range timer I've seen—built in! The SCAMP chip can generate square waves and very complex pulse trains from 50 milliseconds down to several seconds—with only the addition of memory—no PIAs, ACIAs or external timers. Less than $5 worth of extras should provide the hardware for either a Tarbell or K.C. standard compatible cassette interface—or automatic telephone dialing or tone decoding—or . . .

I've no idea how to solve the programming economics, but computer clubs have the highest per capita assemblage of creating problem solvers it has ever been my priviledge to meet. If National doesn't come up with a practical solution, it's very probable that someone else will. National is improving in this area, but their software explanation still appears to be written by and for programmers. Even one of their own "hardware" men couldn't answer my software questions. This may prove to be an unsurmountable problem for me personally, but not for some of you software buffs. The SCAMP is well suited to the software oriented enthusiast, because the hardware is easy. The challenge is in the limited instruction set.

CONCLUSION

I'd like to point up a few generalizations gleaned from painful, expensive experience. Don't expect "Heathkit" type instructions with any kit. The new MITS 680 and SWTP have about the best assembly instructions so far. On the other hand, Godbout tried to explain his EPROM board on one sheet. Don't expect to receive a kit (particularly a new offering) when promised. Debugging always takes longer than the manufacturer expects, even for those who've been in business longest. Optimism always runs rampant in sales departments, so expect mistakes! Except for the SCAMP, every system I've built has had errors and defects in hardware or software that prevented it from operating as advertised. Add these to your own goofs, and expect to a lot of:

—Debugging (get multi-channel storage scopes)

—Telephoning long distance (find a friend with a WATS line)

—Returning components to the factory

—Utilizing computer club workshops

Regarding sending parts back to the factory, MOS Technology gave me the best service. They repaired an intermittent defective chip that had blown out four or five other chips, including the microprocessor at no charge. The KIM went from Hollywood to Pennsylvania, was repaired, and returned to Hollywood in five days. Expect to be pleasantly surprised by the excellent cooperation you get over the phone from everybody. This was outstanding service when compared to some other companies. By and large expect somewhere between 4 and 8 weeks for turn around time on an average.

WHICH IS BEST?

Now, for the $2⁶ question. What's the *best* computer? There is no *best.* What is best for some could be the worst for you. My system costs ranged from $100 for the SCAMP, up to $3,500-plus for the MITS, and nearly ten times that for the DATA WORKS. The optimum for you is a complexity of tradeoffs in which you must consider your own skills and objectives. My opinions are only that—opinions. They may be broader based than most, without commercial interests and with more objective comparatives. But still opinions. Perhaps in some cases, in error. However, it's a starting point for the undecided. Once you've decided where you think you'd like to go, find as many people as you can at the next computer club meeting who've been there.

Rap with them about your selection. There is someone out there who knows more than you about nearly anything you could ask. There are certainly a lot who know less. So help each other. What you get from the manufacturer only goes so far—to go farther you'll probably need help. Club members usually have two things in common—superior intelligence, and painful ignorance. The field of artificial intelligence attracts that type of person.

You're one of them, or you'd be reading PLAYBOY instead of INTERFACE. ◻

COLOR GRAPHICS: A Beginning

by Sheila Clarke

INTERFACE Magazine has received several inquiries asking how to best get up a color graphics system using a home system and color TV or monitor. Since we wanted to settle our own argument at home about *who* was going to do *what* with our only color TV using the ALTAIR 8800, it seemed like a great time to pull together whatever information was available so we could get started in a constructive direction.

We're passing on to you a brief compilation of readily available components, accessories and software that hopefully will help you get your color graphics project off the ground. First, of course, you need a color display device. You'll need to provide intelligence and a means of allowing that intelligence to be communicated and converted to something the display device can work with; in other words, a processor for intelligence, a color monitor or television set, and circuitry to convert and communicate between your processor and monitor. A separate mass storage device is desirable, but not essential. Without mass storage, however, we're talking about a bare-bones system.

Application should be considered before choosing your hardware. The available software for a color graphics computer is becoming more plentiful. Most software available on the home computing market ranges from games and moving pattern display to charts and graphs. If you've thought up an application that's a little avante garde, however, like converting music to a series of changing pattern displays, chances are you'll also have to know more about software writing than most programs provide, and a little about hardware modifications.

This article is only meant to introduce you to available hardware and software in general terms. Since most of you are already involved with home computing, probably using an 8080 based system, we'll assume you have one up and running and go from there.

CONVERT YOUR TV SET

Provided you already have an Altair, IMSAI, or other 8080 based system, and you own a TV set that the whole family enjoys, you can return to budget-conscious grace by buying a converter kit that will allow you to use the TV either as a receiver or a color monitor. The one most recommended is called a Pixe-Verter. The kit costs $8.50 and takes about 30 minutes to assemble. It's available from ATV Research at 1301 Broadway, Dakota City, NE 68731.

RF modulators are available ready-made at radio and stereo electronics stores. We priced one locally at about $7.50. This is a switch device that is manufactured to accompany TV game devices like "Pong."

INTERFACING

The Dazzler, produced by Cromemco in Los Altos, California, is the most prominent interface being used. This microcomputer interface has been designed specifically to allow your color TV to be your display terminal, and only takes 2K of memory. It outputs a video signal directly into the TV video amp with the help of the RF modulator, discussed above.

After talking with several who have used the Dazzler, we have a couple of additional hints you'll want to know about. The Dazzler is designed for positive video sync. Most monitors, and many TV sets with direct video input capability, require video signals with negative sync pulses. The circuit in Figure 1 is suggested by Cromemco engineer Joe McCrate, to invert the positive sync video signal which the Dazzler produces. Sony is one TV we know of which requires this modification. To be sure your TV needs the inverter, we suggest you check the video sync pulse with a scope. If the sync pulse is negative, you need the inverter. If you've gotten as far as the first stage hook-up to your computer and the picture won't stabilize on the screen, again, you'll need to invert the sync pulse.

Another important item you should be aware of before hand is whether or not your TV has an isolation transformer. Many, like Sony, do not. You'll need one.

WHICH CRT?

Using the family television set can cause family feuds. The most reasonable way to keep the peace is to locate a good used set. We've found prices as low as $150 for 18" to 25" sets, listed in the classified ads. For game playing and making pretty pictures, commercial TVs offer adequate resolution.

The purist, however, might look for something with better resolution to satisfy his artistic endeavors. If you're one of those purists, be prepared to spend a little more for your CRT. Color monitors are manufactured by several major producers, with resolution in varying degrees of better quality than consumer models, and usually encased in metal, rather than decorative plastic or wood. Well-reputed monitors include RCA, Sony Trinitron and Sanyo. RCA's model JU-970W is a 25" monitor that currently sells to TV studios for approximately $500. Sony Trinitron is a 12" model with infinitely better resolution, and is more readily available over the counter at about $600. The Sanyo, a 19" monitor comparable to the RCA, was priced at The Computer Mart in Orange, CA at $725.

HANGMAN, Tennis and Lunar Lander are just three of the games offered by Intelligent Color Corporation's software package. The Intecolor Program Development System in the lower right photograph enable's the user to enjoy immediate recognition, using complete alphanumeric and scrolling graphics.

A blank area remains on the screen for CRT input. Used in this way, the Intecolor 8001 is a complete stand-alone system.

Until recently, most monitors haven't been available to the consumer, and have been sold directly to commercial users like television studios. Though the

Sony and Sanyo are now available, they're expensive. It is possible, however, with true determination, to overcome that obstacle. If you know someone in the industry, or any related field, you might get help purchasing a monitor, new or used, at a more reasonable price. If you don't know anyone who can help, watch the classified ads and motion picture industry trade publications for advertisements of auctions and sales of used equipment.

COMPLETE COLOR GRAPHICS SYSTEM

The INTECOLOR 8001 is a stand-alone system offered by Intelligent Systems Corp. Using an 8080 CPU, the 19" intelligent color terminal is available in kit form for $1395. The kit includes the color CRT terminal, RAM refresh memory, keyboard, bell, selectable baud rate up to 9600, and instructions. The display handles up to 2,000 characters in an 80 character by 25 line format, and 64 standard ASCII characters in a 5 x 7 dot matrix in the standard package. Also, it's TTY compatible. Lots of options are available to increase this system's capabilities, including single floppy drive, controller, light pen, source tape and listing. The INTECOLOR 8001 has been in use for some time in business applications for process control, security systems and air traffic control, and so has been tested out. To know more about the range of possibilities for this, or any color system, you might write them for their brochure at 4376 Ridgegate Drive, Duluth, GA 30136.

SOFTWARE

More software seems to be available than hardware for the hobbyist. Cromemco is devoting most of their development time these days to new programs. They'll soon be out with their version of "Hexpawn," to name one. They've also generated a raft of new games and graphics displays through a contest promoted by People's Computer Company. The contest closes at the end of September, and we expect to see lots of new programs available. Cromemco offers programs on paper tape for the 8080 in BASIC at $15 each.

Intelligent Systems Corporation (INTECOLOR 8001) has an option to the basic system: expanded graphics software designed to be used with their graphic plot hardware. The software and hardware together are priced at $66, including an X-Y point plot. ISC uses BASIC and erasable PROMS compatible with the 8080. In contrast to Cromemco's "fun and games," ISC software has been designed for business systems, providing charts and graphs.

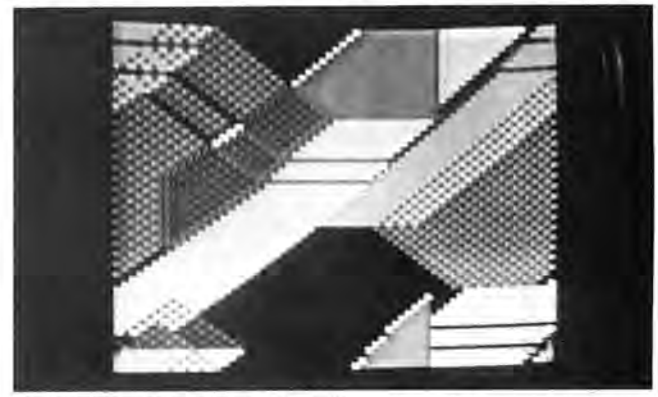
Remember too, that a number of hobbyists are developing their own software, freely shared among fellow home computerists. Some computer clubs are developing software libraries for this purpose, and we look soon for additions to software collections designed for color graphic displays.

EXAMPLE SYSTEM

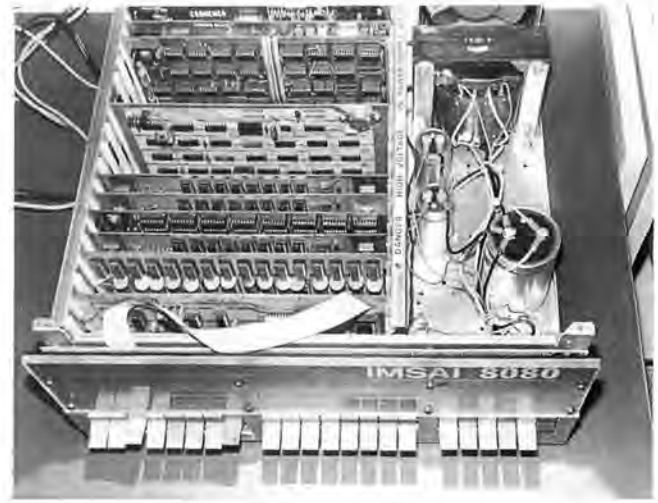
When I walked into the Computer Mart in Orange, California, I was invited to join the computer in a friendly game of tic tac toe . . . in color! Not only was it intriguing to watch, but I won! Once, anyway. The game was written for Cromemco by George and Charles Tate, and it's available on paper tape.

I continued to watch, fascinated, as one program after another was put on the screen for my entertainment. "Kaleidoscope," also from Cromemco, runs without keyboard entry, and displays a continuing symmetrical color pattern change.

"Dazzle-Mation" required the most creative input by the user. Here you can see an example that Rick Edelman created for me to photograph. The people



at the lab where I had the film printed thought it was a picture of a calico patchwork quilt! I'm sorry you can't see it in color, as it gives a stunning effect. What I preferred about this particular program was the infinite combinations the user can create. The operator must key in lines, dots and dashes, using different colors. Then he presses the "run" key and watches it go into action, filling the screen with a brilliant motion of ever changing planned color and pattern.



Components used to make up the system at Computer Mart are: IMSAI 8080 with added Dazzler and additional memory. Altogether the unit has 24K. Tic

Tac Toe takes 20K. The Tarbell Cassette Interface and tape recorder make up the I/O for loading programs. The ADM-3 terminal and keyboard is interfaced with Processor Technology's I/O board to control the action and color video monitor is a Sanyo 19". The cost: approximately $3,500 total, all in kit form (except the monitor). This particular system has been designed to handle any application possible.

COMMERCIAL TELEVISION COMPETES WITH HOME COMPUTING

I spent some time with the RCA marketing people to get a reading on what the future might hold for game playing for the whole family. Lots of game devices are on the way. "Pong" is here already, Hitachi is developing several game devices that attach to your television set, and games like chess and blackjack, as well as educational games for the kids, will soon be available in department stores. Some computer stores are selling similar devices.

Many of us are intrigued with the idea of creating our own computer graphics displays, but time and money barriers are holding us back, or family objections to monopolizing the only TV set in the home make it seem an impossible dream. So, romance your family into the fun that computer games and graphics can be. While they spend endless hours occupied with ready-made devices, you can be assembling your hardware and programming your computer to take over when the store-bought stuff has lost its fascination. In the meantime, those commercial games might be the ideal alternative to "All In The Family."

Who among you has a computer graphics system up and running? If you do, you're something of a pioneer. Our readers would be very interested to know what comprises your system, and what applications you're using. INTERFACE would like to know, and if warranted, we may devote a regular section to color graphics applications.

So let's hear from you!

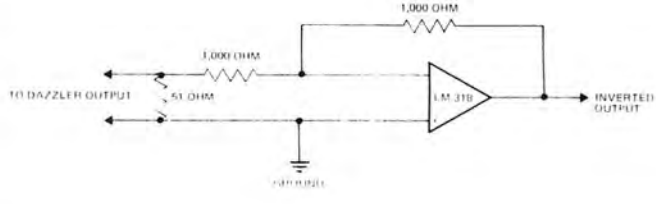


Figure 1.
INVERTER USING LM 318 OP-AMP

By Cliff Sparks

This is the eighth and final article in a series designed to prepare the reader to better understand their Model 33ASR/KSR.

In the first article (January '76) we defined the Call Control Unit as the switchboard of the 33ASR/KSR. We will look into the UUC-6 Call Control Unit as it seems to be the most common unit available to us.

Teletype Corp. provides its users with many special call control units. Not all of these units are easily adapted to our use, so watch out, friends.

I have found that the UCC-3 and UCC-6 are easily adapted to acoustic coupler, RS232, or current loop operation. Be very careful you do not become the owner of a 33ASR that has a special call control unit designed for a custom system.

These special systems often do not require a local current loop circuit deriving their local loop from an external source. The result is that your 33ASR/KSR will run open, and you'll find you don't have a closed loop within your selector magnet circuit.

Now I understand that nothing is impossible, nor too difficult for the enthusiast faced with an electronic problem. Although I feel it's not worth the trouble and expense to adapt a special call control unit to suit your needs, I'm sure I'll hear from some eager fellow who has successfully wired his unit through the garbage disposal, (buffered by the color TV), and interfaced it to his 8080 via the telephone. More power to you, friend, but for more direct and less expensive results, I suggest we start with either a UCC-3 or UCC-6 Call Control Unit.

A good rule of thumb is to shy away from a Call Control Unit with a telephone-type dial or a touch-tone key pad.

The 115VAC power distribution schematic for the UCC-6 type Call Control Unit (CCU) is shown in Figure 1. Power for the motor, selector magnet drive, local power supply, and tape reader power pack, when provided, is supplied from fused 115VAC, 60 Hz power. Direct current of either .020 or .060 amps is required for the signal line and for operation in the local mode. Battery for the signal line is supplied by the 8080 or whatever device you are communicating with, while local battery for operation in the local mode is furnished through operation of the local power supply circuit in the call control unit (CCU). At the rear of the CCU is a terminal

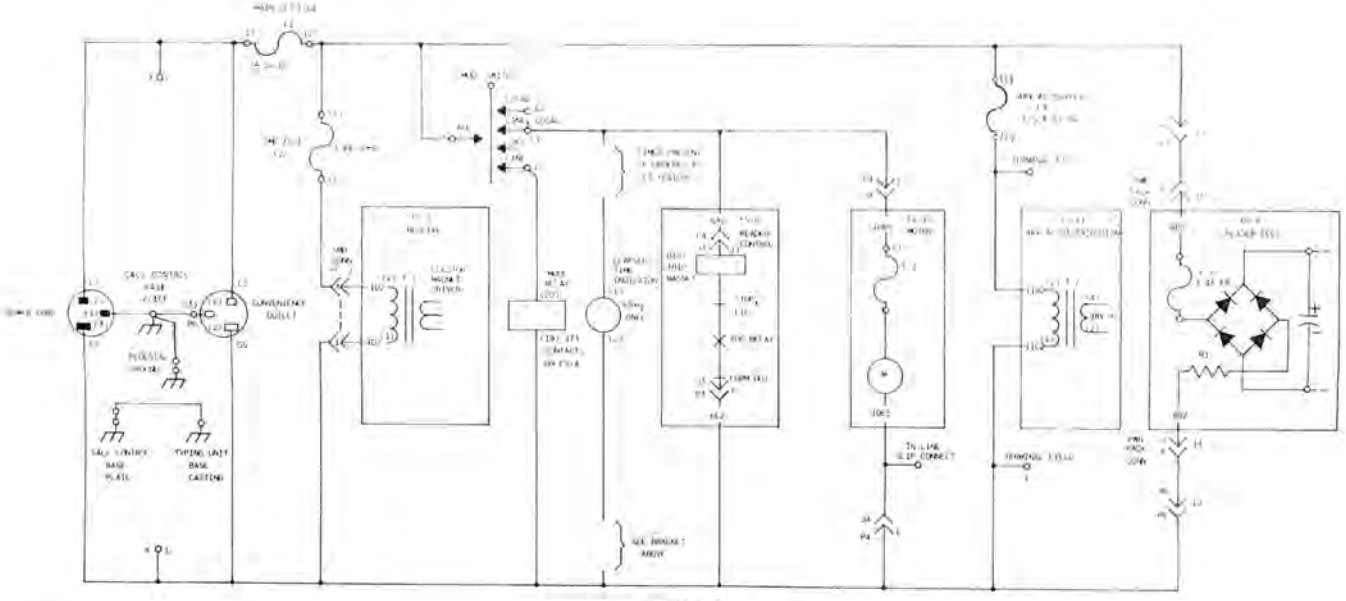


FIGURE 1

strip which provides the point of entry for the ac power and the signal line into the teletypewriter.

This terminal strip has nine connections, and is referred to as the "X" block. Almost all of the connections on the "X" block may be found on the eight Molex connectors just above it.

The purpose of the selector magnet driver is to amplify received dc marking and space intelligence pulses. Received dc data pulses are directed to the input of the selector magnet driver circuit in the CCU where they are amplified and returned as 0.500 ampere dc intelligence pulses to operate the typing unit selector.

The 3-position rotary mode switch (shown in Figure 1) is the only manual control on the call control unit. Through its operation, the teletypewriter can be placed in the external signal line loop for communication with your 8080, or removed from the external signal line loop for local operation, or placed in the off condition when the wife gets tired of the racket.

Let's take a close look at the Mode Switch. The following chart indicates the condition of the rotary switch contacts, either open or closed, when the control knob is turned to one of its positions:

KNOB POSITION	LINE SEGMENT FROM	TO	CONTACTS CONDITION
Line	L1	2	Closed
	L1	1	Closed
	L2	2	Open
Local	L1	2	Closed
	L1	1	Open
	L2	2	Closed
OFF			All Open

All power in the CCU, except that applied to the selector magnet is off when the switch is in the OFF mode. In the local mode of operation, the power will not energize the line relay, and the local battery is supplied to the selector magnet drive and "send" circuit. (See Figure 2.)

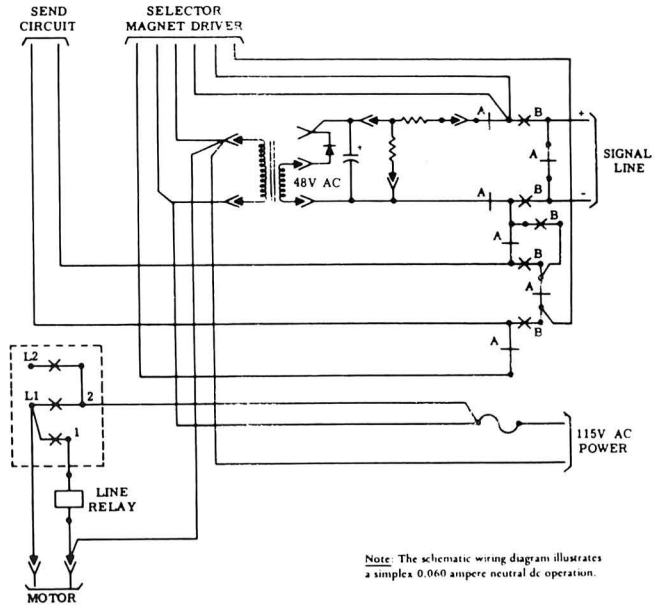


FIGURE 2

Figure 2 shows us the normally closed contacts *A* remain closed, and the normally open contacts *B* remain open in the local mode of operation. The external signal line loop (from your 8080) is divorced from the selector magnet driver, and shunted so that any other device within your loop can communicate without being affected by the operation of the local teletypewriter.

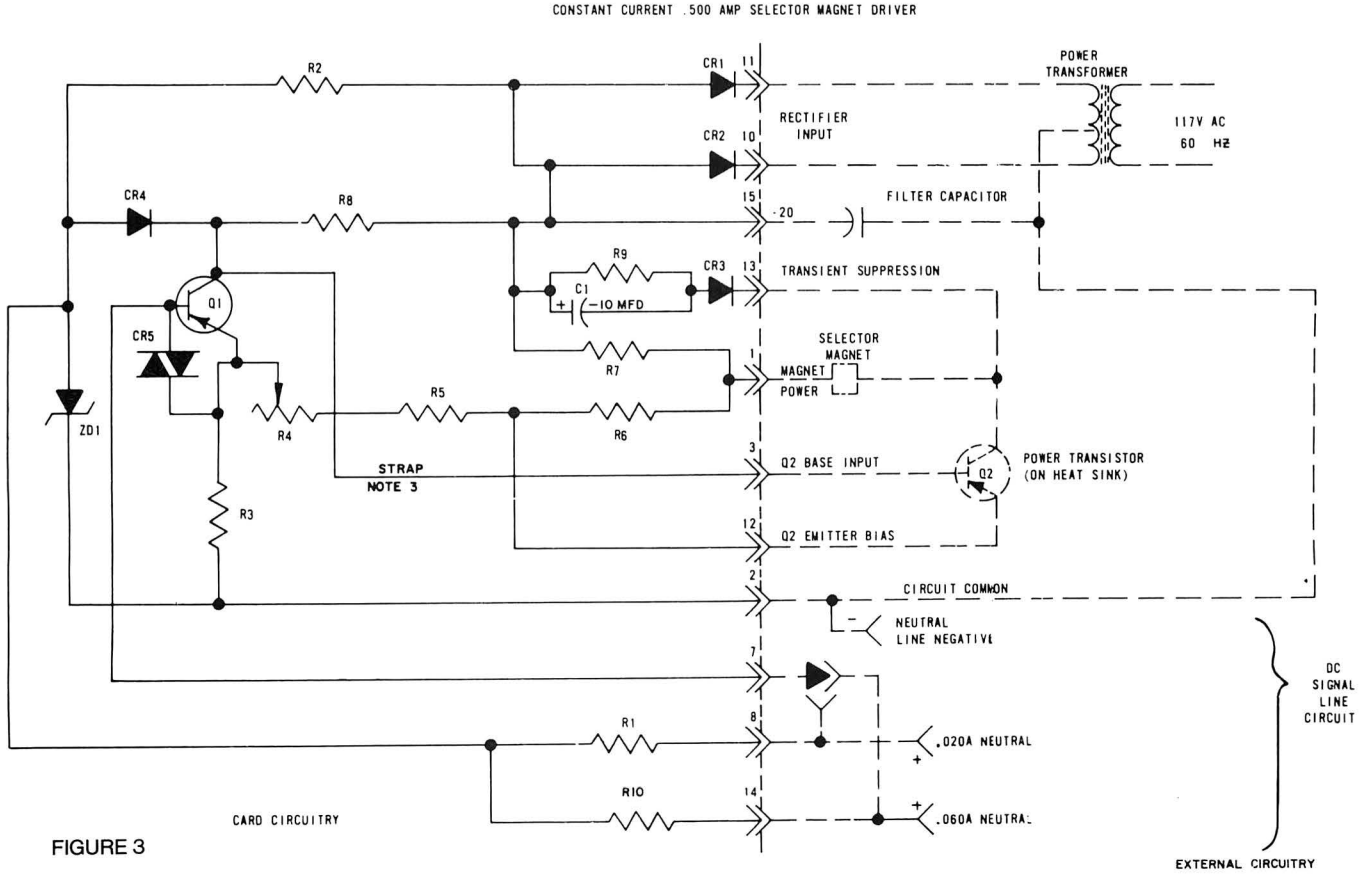


FIGURE 3

In other words, you could have a tape unit, key punch, or video device working into your mini, while punching tape in the local mode on your teletypewriter.

When you switch to the line mode, the line relay energizes, and the battery is on the signal line.

The signal circuits pass through the normally closed contacts *A* and will open them; the normally open contacts *B* will close. The external signal line loop is united with the selector magnet driver, and the local teletypewriter can now communicate with any device in that loop.

The Selector Magnet Driver circuit (Figure 3), combined with an external power transformer and filter capacitor, provides a 0.50 amp current for driving the selector magnet from a telegraph signal source of appropriate input line current. The input signals are applied through terminals 6 and 11 (on the SMD plug-in card), with R1 determining the switching level.

For a mark input, a positive current is applied to terminal 11. This will provide a positive bias to the base of transistor Q1 that overcomes the normal negative bias supplied through R1 and stabilized by the zener diode ZD1. Q1 will turn off as the increasing positive current reaches half its final value.

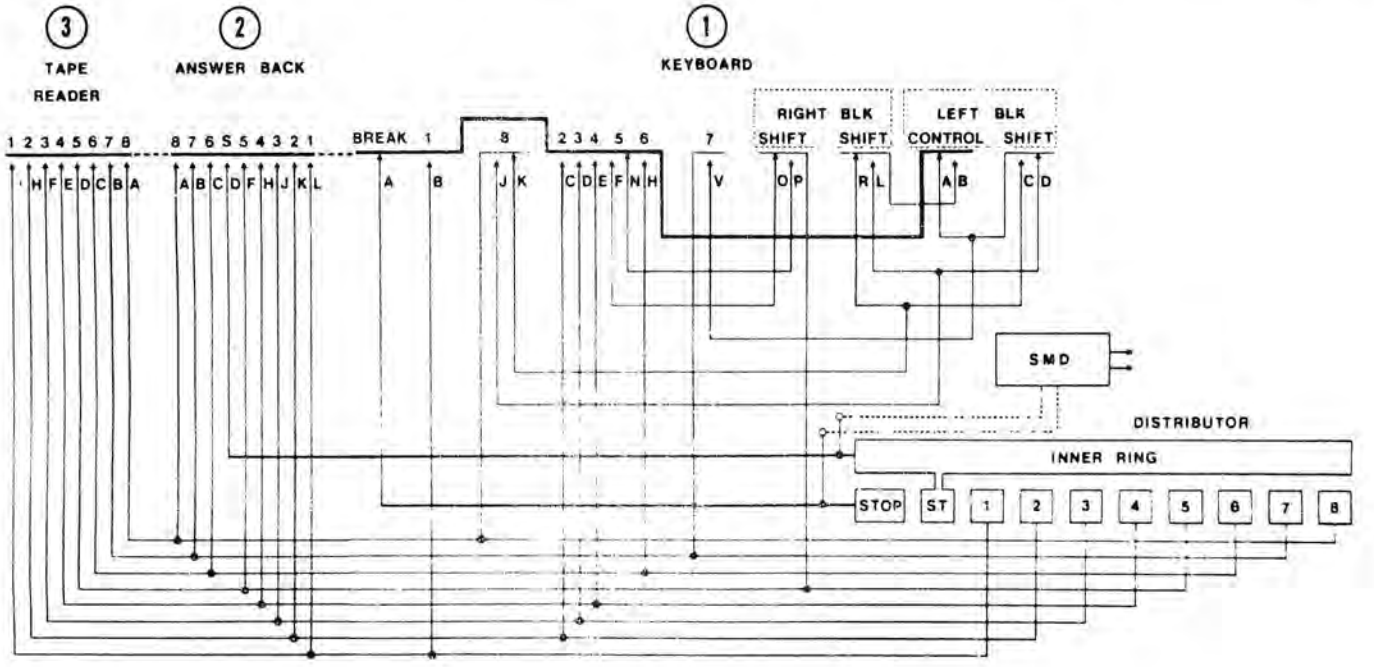
The collector of Q1 then goes negative, and this negative potential is applied to the base of QA, and turns QA on. R4 will provide emitter bias to Q1, and supplies a regenerative action to the transistor.

The selector magnet is connected between the collector of QA and the junction of R7 and R8, and supplies the load for QA. "On" marks the current rises to 0.50 amps and energizes the selector magnet. On spaces, the positive input bias decreases, and Q1 is turned on at the half-line current point by negative bias through R1. The collector of Q1 rises towards a zero potential, applying reverse-bias to QA, turning off QA, and de-energizing the selector magnet. The selector magnet opposes the change in current, and applies a transient potential to the collector of QA. CR3 will not conduct and pass the transient potential to C1 and R5, which limits the potential to a value well under the breakdown voltage QA, while selector magnet energy is being dissipated. Kind of looks like what we have is a simple flip-flop action going on between QA and Q1. We might even look at the signal input as being the trigger or clock.

Let's stop at this point and review what we have covered. The CCU mode switch gets our equipment either on or off the line, the SMD circuit provides our internal current loop to the magnets, and we have two transformers within our CCU, one for the SMD circuit (T1), and one for the 48VAC (T2). If we have an automatic tape reader, then we'll have a second PCB card either attached to the right side of the CCU or within the ASR pedestal. We also have a mode relay through which just about everything runs. Last, we have eight Molex connectors; eight females and at least four males. They are in two rows of four each numbered in the following manner (see Figure 4):

Look from the rear of the machine and note the upper left Molex is number 1, also known as BD. BD, or

BRANCH TO . . . pg. 66



The parallel output circuits are routed through the set CALL CONTROL UNIT, and terminate at the set DISTRIBUTOR.

(1) KEYBOARD--plug #7

(2) ANSWER BACK--plug #8

(3) TAPE READER--plug #6

FIGURE 4

TTY Single-Character Reader Control

By Tom Gallant

For the home computerist who must live without the convenience of a random access storage device, the problems of running a two- or three-pass compiler can be frustrating.

Besides the necessity of reloading—or loading the next segment of a compiler, one might wish to overlay part, or all, of a program in memory without disturbing data which has been temporarily stored. Or, data input on paper tape might be so extensive that storage in memory along with the program is impossible. In this case, it would be desirable to read one character or block of characters at a time, processing and possibly outputting results on the print device before reading the next block. The device described in this article will allow the necessary control to accomplish these and other functions demanding punch paper tape reading under program control.

The TTY reader control allows computer control of the tape reader on Teletype model ASR-33 with manual or automatic readers. The reader control itself may be enabled or disabled under program control. Once set, the control function is completely automatic. The circuit allows for single character or "normal" block reading.

The reader control is enabled by the I/O board input interrupt. Machine interrupt enable is not required, and in most cases not desirable (unless your program uses interrupts, which is feasible).

To enable the reader control (assuming TTY is at ADDR. 0 and 1):

	In Machine Language	In MITS BASIC
MVI A	076	POKE 0, 1
	001	
OUT	323	
	000	
JMP	303	
	XXX	Your
	XXX	Program

Don't forget to turn on the reader!

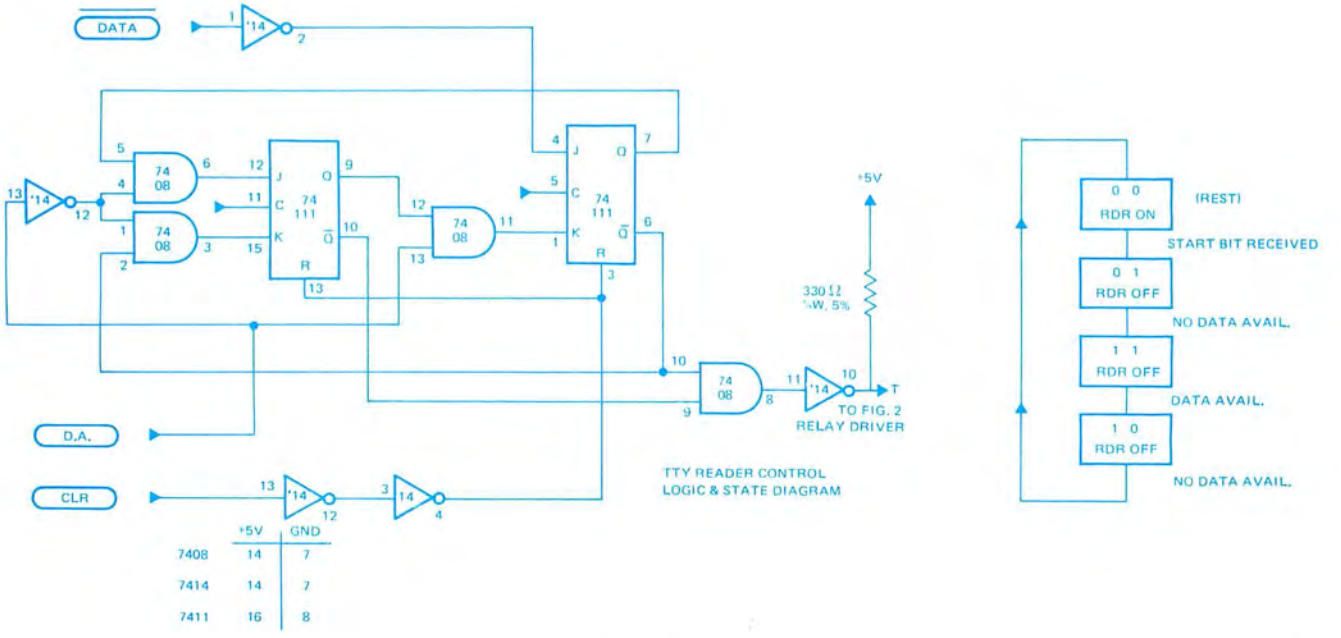


FIGURE 1

The small wonder

of the micro-world

Measuring just 11" wide x 11" deep x 5" high, and weighing a mere 7 pounds, the Altair™ 680b is a complete, general-purpose computer.

The secret to this revolutionary, small computer is its CPU board. This double-sided board fits along the bottom of the Altair case and plugs directly into the front panel board. It contains the new 6800 microprocessor, 1,024 bytes of RAM memory, a 256 byte PROM monitor, provisions for 768 bytes of additional PROM or ROM, and a single Interface port with a Motorola ACIA serial interface adapter which can be configured either RS-232 or TTY. A five level Baudot interface option is also available.

The Altair 680b can be programmed from front panel switches, or it can be interfaced to a video display terminal, or teletype-writer. Three additional circuit boards can be plugged inside the Altair 680b for further memory and interface expansion. The first of these boards is a 16K static RAM memory board.

Software already developed includes Altair 680 BASIC with all the features of the 8K BASIC previously developed for the Altair 8800. These include Boolean operators, the ability to read or write a byte from any I/O port or memory location, multiple statements per line, and the ability to interrupt program execution and then continue after the examination of variable values. This software takes only 6.8K bytes of memory space and a copy is **included free with the purchase of the Altair 680 16K memory board.**

Other software includes a resident two pass assembler.(also free with 16K board) The Altair 680b is also compatible with Motorola 6800 software.

The Altair 680b is ideal for hobbyists who want a powerful computer system at an economic price. Altair 680b owners qualify for membership in the Altair Users Group, and like other Altair owners, they receive a complimentary subscription to **Computer Notes** and complete factory support.

PRICES:

Altair 680b kit with complete, easy-to-understand assembly manual, operator's manual, and programming manual	$466
Assembled Altair 680b	$625
Altair 680b Turnkey model kit	$395
Expander Card 680MB (required to expand 680)	$ 24
Altair 680BSM 16K static RAM board kit with 680 BASIC	$685
Altair 680 BASIC when purchased separately	$200
Baudot option	$ 42

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NOTE: Altair is a trademark of MITS, Inc.

Price, specifications subject to change. Please allow up to 60 days for delivery.

CIRCLE NO. 8 ON INQUIRY CARD

To disable the reader control, change the second entry above (001) to 000. This then allows normal operator control of the reader. (In MITS BASIC, use POKE 0, 0.)

OPERATION

When you turn the tape reader on in normal teletype operation, what you really do is energize the reader trip magnet. This trip magnet does two things: first, it trips the distributor clutch, via the reader trip lever, and second, it closes a set of contacts to supply power to the tape reader itself.

Now, when the distributor clutch has completed one revolution, i.e., transmitted one character, it resets the reader trip lever, removing power to the tape reader. If the trip magnet is still energized, the whole cycle repeats, reading the next character. However, if power has been removed from the trip magnet, the reader trip lever is latched in its reset position. This keeps power from the reader so it can't read the next character.

The modification described here obtains single-character reader control by removing power to the trip-magnet as soon as the first bit of a character is transmitted. Power is restored when "data-available" on the I/O board disappears, indicating the computer has actually input the character.

The additional logic used (Figure 1) may seem a little like over-kill, but is required. This is because the UART (Universal Asynchronous Receiver/Transmitter) on the I/O board doesn't maintain the "data-available" signal throughout its read cycle. This necessitates that the logic "remember" that a "data-available" has occurred.

INSTALLATION

The logic board (Figure 1 and left and lower part of Figure 2) should be mounted in the computer since there is a persistent noise problem when mounted in the TTY (as this writer discovered the hard way). A separate board should be used to mount the relay circuit (upper right of Figure 2) in the TTY. There is an unused mounting bracket just to the right of the keyboard in many machines that may be used for this purpose.

By the way, the screw holes are tapped for No. 5 screws, rather than the more common No. 4 or No. 6. The best source for this size screw is a barrier terminal strip; these are the only two places I've seen them used. The reason for mounting the relay board in the TTY is to avoid running 120 volts from the reader trip magnet into the computer.

As the TTY line relay (Figure 3) is buried in the right rear corner of the TTY under a maze of wire, that corner of the machine will require some dismantling for access. A word of caution: Don't drop any hardware —you'll never find it again! Use shrink-tubing everywhere here (120 volt) and wire with sturdy insulation. The relay contacts were originally used to short out the TTY input line when in the local mode. This is no problem for computer use, but the relay wiring must be restored if the TTY is to be used to communicate directly with another TTY such as in private wire service.

If the program crashes, the reader control may come up in the wrong state (state diagram, Figure 1). If the reader won't start, turn it off. Operate the "clear" switch on the computer front panel, and turn it back on.

NOTES ON USING

If you are lucky enough to own a teletype with an automatic reader (one that recognizes the DC1 and DC3 ASCII codes for reader-on and reader-off), you can use both this character-control and the ASCII codes. This would allow for things like inputting blocks of fixed data from tape. Have the computer turn off the tape reader and ask for keyboard input, then have it turn the tape reader on again. If you do this, there is one fine point of which you should be aware. The I/O board UART is always holding the next tape character, waiting for the computer to get around to reading it. This means that the first character the computer sees when expecting keyboard input will be the next character from the tape. If you are using a

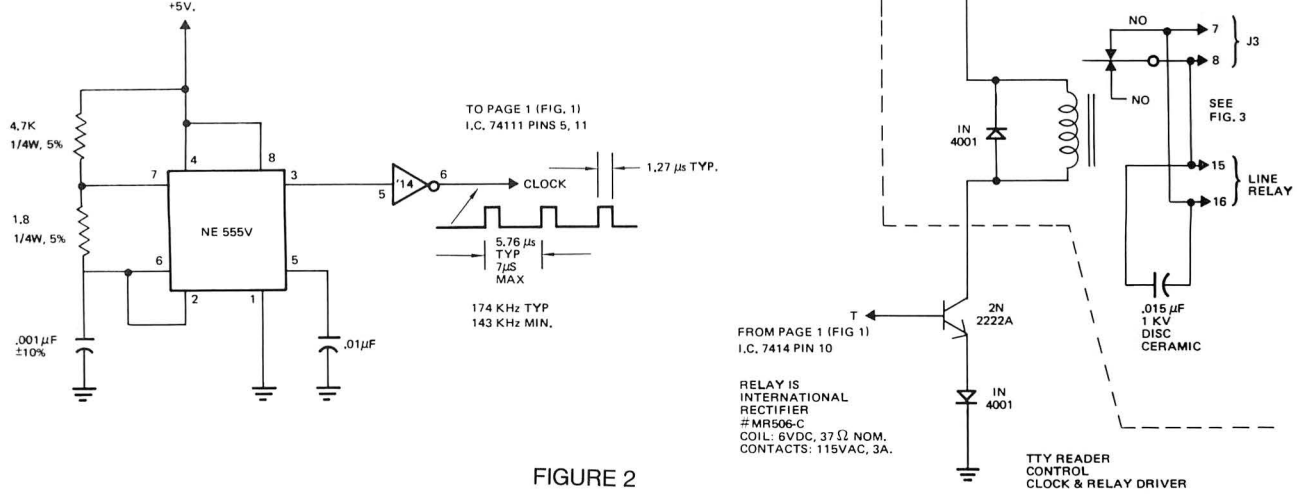


FIGURE 2

block-formatted tape, the easy way around this would be to punch an extra end-of-block character or a null after each block. On ASCII tapes, the carriage return would usually be considered an end-of-block, and the following line feed is typically ignored anyhow.

If you aren't using block-formatted tape, then your program could possibly store the first "keyboard" character in a one-byte buffer area for later retrieval.

This single-character approach is also quite useful when using higher-level language compilers and interpreters that may be a little slow. For instance, the manual for one of the more popular BASIC's stage: "Paper tapes punched by other BASIC's may have no nulls at the end of each line. Instead of the three per line recommended.

To get around this, try to use the tape feed control on the teletype to stop the tape from reading as soon as a carriage return is typed. You can actually hear the tape reader stop and wait for the computer when processing a long line of instructions!

Another possibility is data input to programs written in the higher-level languages. A minor problem that arises is that there often is a provision for the user to interrupt program execution from the keyboard. After every instruction is executed, the I/O board is interrogated to see if a character has been received. If one has, it is inputted and tested to see if it is the program interrupt character. Since the I/O board would have the next data character from the tape, this would be input and lost.

What you do is patch the language, so instead of interrogating the I/O board, it interrogates the sense switches. You then would still be able to interrupt program execution by flipping the appropriate sense switch (after you turn off the reader) and typing the control character, but you wouldn't lose any tape data during program execution.

For instance, in MITS basic version, 3.1 8K, if you raise sense switch 8 (assuming revision 1 serial I/O board, S.S 9 for Rev. 0) and do a "POKE 1418,255," you're all set, usually. It seems that there are two versions of 3.1 8K around, and some of the instructions are moved up or down one address. Better do a "peek" around that 1418 address. When you find a 219 followed by a zero, you've got it. It's that zero you want to "poke" to a 255. To restore normal keyboard program, interrupt "poke that 255" back to a zero.

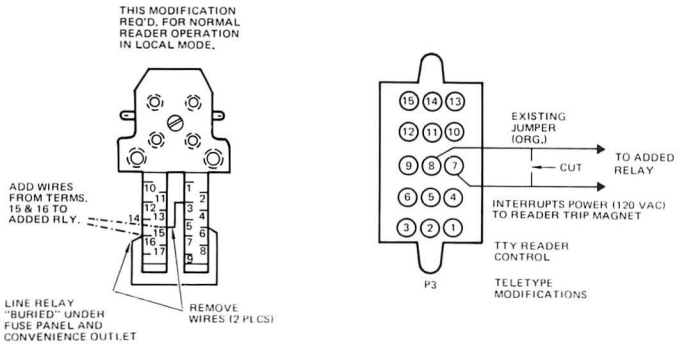


FIGURE 3

CUT THESE
TO PAD "IN" AT TOP EDGE OF BOARD
IC "D" PINS 5 & 9
IC "D" 6
IC "D" PINS 3 & 4 (FRONT OF BOARD, HAVE FUN)

ADD WIRES

IC PIN	IC PIN
D 3	U 3
U 4	TRACE THAT USED TO GO TO D6 (PAD "BH")
D 4	C 12
D 5	U 9
D 6	I/O PIN 8 (DATA)
D 1	U 1
U 2	U 13 AND TO I/O PIN 1 (D.A)
U 12	TRACE THAT USED TO GO TO D1 (PAD "IN")

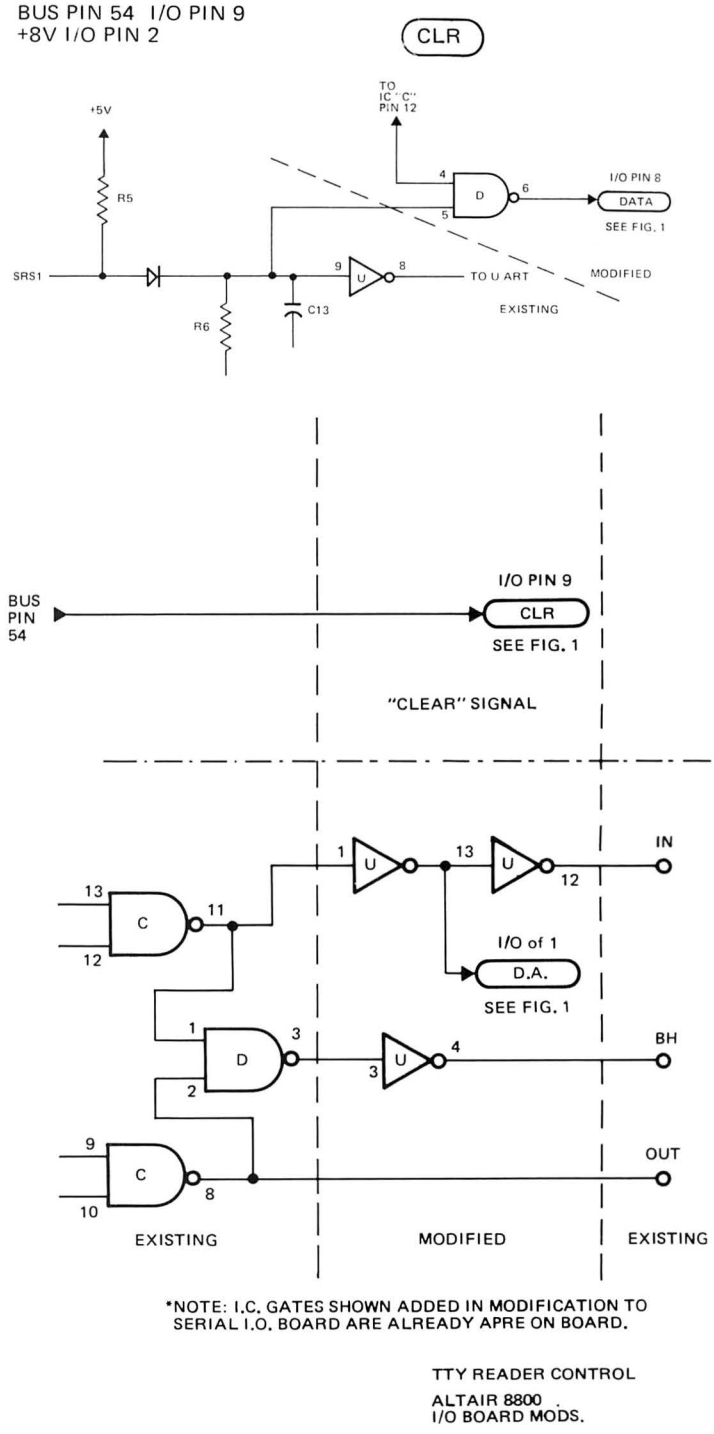
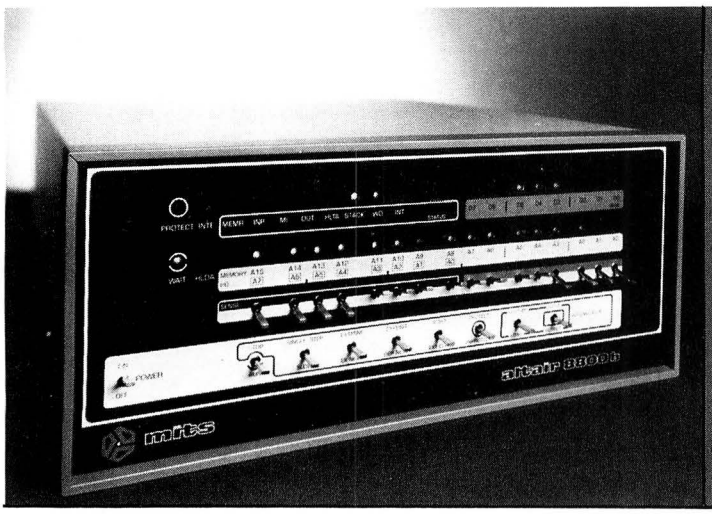


FIGURE 4

PRACTICAL APPLICATIONS

I don't know if you would call this practical or not, but one night, three of us got hooked on a version of lunar lander and decided to land in one piece. We managed to get the first part down pretty well, but

BRANCH to . . . pg. 66



A NEW PONY—

THE ALTAIR 8800B

by Andrea Lewis

The "Land of Enchantment" can boast of its many scenic areas, cultural heritage and vacation paradises for all to enjoy, but lately it is becoming even more famous for its outlandish TV Marshall Sam McCloud and its unorthodox computer manufacturer MITS. Yes, New Mexico hosts many virtues and wild legends that inspire many controversies. Whether or not they are true seems to be of little value. I'm sure it won't be too far in the future when Sam will have to return to Taos—at least for a visit only to find out that his law enforcement buddies have traded in their ponies for a new computer from that darn 'ol computer manufacturer in Albuquerque—the bastions of the frontier crumbling under the advance of technology.

At the rate that MITS is gearing up production, the legend of the long delivery will vanish with the setting sun.

Introduced only a short time ago, the Altair 8800 B is in full production with deliveries improved vastly.

An indepth look is provided for this new 4K legged beast.

By being at the vanguard of the computer movement, MITS has been in a unique position to assimilate feedback and new information from many sources: from hobby customers, from business users, from computer design industries. All of these influences have been percolating at MITS since the first Altair computer came off the line, and the current result is the Altair 8800b. They feel it will be "the mainframe of the 70's."

As anyone associated with microcomputers will tell you, the field is evolving so rapidly that keeping current is almost a day-to-day job. The Altair 8800b incorporates many new electronic and mechanical features including some of the newer integrated circuits for the 8080 family of microprocessors.

The new design features of the Altair 8800b that will be discussed here include: enhanced front panel capabilities, new Display/Control logic, the Front Panel Interface Board, the new CPU Board, added bus lines and heavy duty power supply.

Additional Front Panel Switch Positions

Five new front panel switch functions have been added to the Altair 8800b computer to expand the front panel capability:

- SLOW function: Permits execution of a program at a rate of approximately 2 machine cycles per second or slower. The normal machine speed is approximately 500,000 machine cycles per second. Useful in debugging programs where it would be too time consuming to single step through the code.
- DISPLAY ACCUMULATOR FUNCTION: Displays the contents of the CPU accumulator register on the front panel data LEDs.
- LOAD ACCUMULATOR FUNCTION: Loads the CPU accumulator register with the information present on the lower eight front panel address switches.
- INPUT ACCUMULATOR FUNCTION: Inputs the information present at an input/output device into the CPU accumulator register. The input/output device is selected on the upper eight front panel address switches.
- OUTPUT ACCUMULATOR FUNCTION: Outputs the contents of the CPU accumulator register to a selected input/output device. The input/output device is selected on the upper eight front panel address switches.

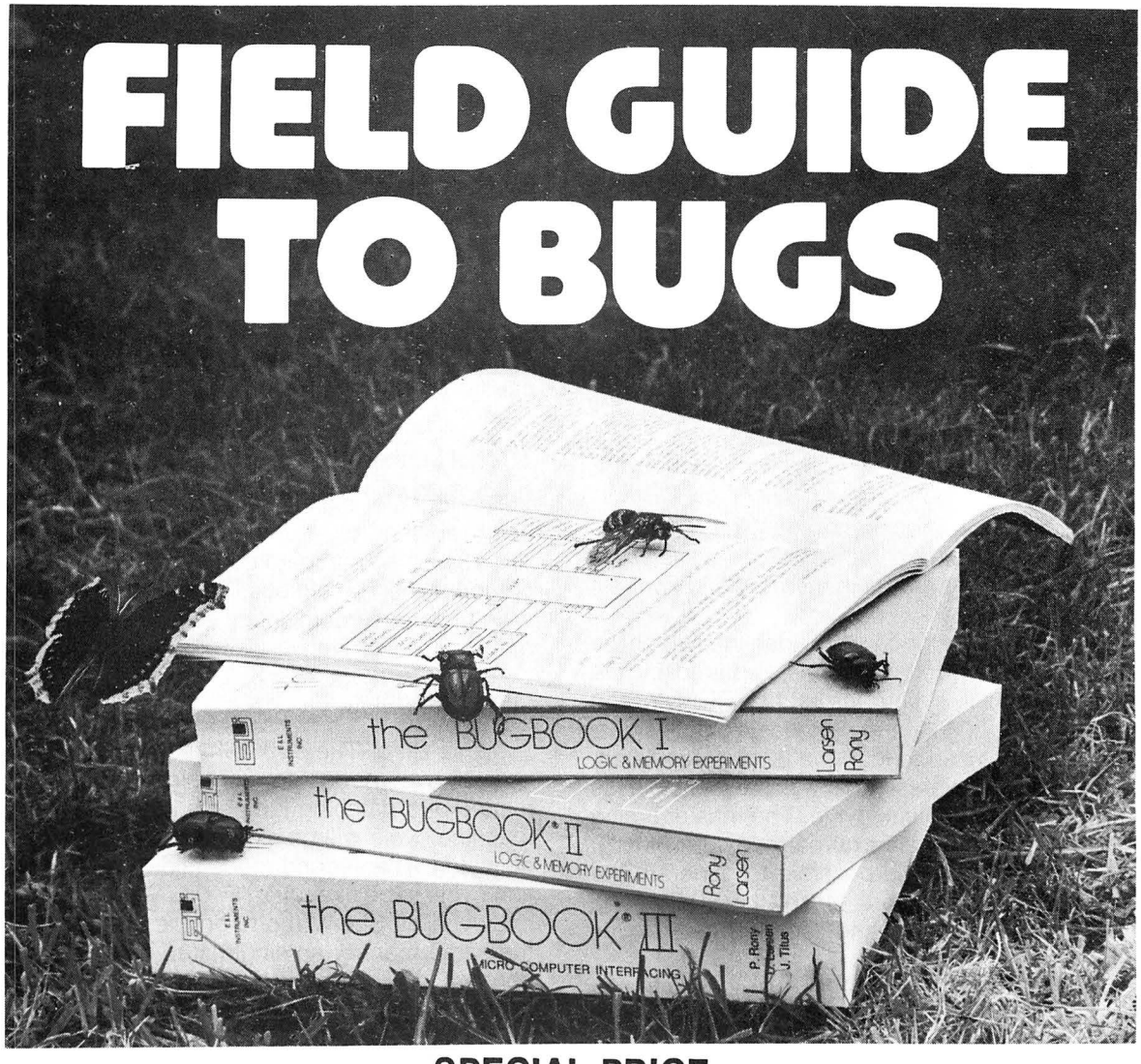
Dress Panel

A new multi-color dress panel with functionally designed graphics is used in the Altair 8800b. The front surface of the dress panel has a protective sheet of mylar to insure that the graphics are not rubbed or scratched off. The LED indicators are now back-lit through the panel and the toggle switches have 50% longer handles that are flatted (instead of round) for easier use.

Front Panel I/O Capability

The 8800b has I/O channel 255, and effectively channel 254, dedicated to the front panel. As with the Altair 8800, an input from channel 255 (octal 377) will input the contents of the Sense Switches (A15—A8) to the accumulator. The 8800b has the added feature that an ouput to 255 will display the contents of the accumulator on the data LEDs. In addition, one can configure this I/O channel (by means of patching jumpers) so that all outputs (to any I/O channel number) are shown on the data LEDs and/or all inputs (from any I/O channel number) are shown on the data LEDs.

Electronically the Display/Control Board has been completely redesigned. The logic design is now totally synchronous. The design approach used in the Altair 8800b



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is to allow the Display/Control logic to assume control of the CPU and jam the instructions necessary to implement the Front Panel functions.

All the lines between the 8800b bus and the Display/Control Board are now buffered through a Front Panel Interface Board. (The bus lines no longer directly drive anything on the Display/Control Board.) The Front Panel Interface Board connects to the Display/Control Board by means of two 34-conductor ribbon cable assemblies, eliminating the wiring harness between the Display/Control Board and the bus.

The CPU Board consists of four major functional blocks:

8080A CPU Chip
8224 Clock Generator Chip
8212 Status Latch
Drivers and Receivers

The 8080A, the microprocessor chip itself, exercises control over the CPU board and the rest of the system. It executes the instructions stored in memory and controls all the data transfers.

The 8224 clock generator chip provides the two-phase clock (at the specified voltage levels) required by the 8080A. In addition, it synchronizes the READY and RESET inputs to the 8080A and provides a status signal (STSTB) that can be used to load the 8212 status latch. This guarantees that status data will be available as soon as possible in a machine cycle. The master timing reference for the 8224 is an external crystal (18MHz). By changing this crystal it is possible to generate the clocks used by the faster versions of the 8080A: the 8080A-1 (1.3us cycle time) and the 8080A-2 (1.5us cycle time).

The 8212 status latch outputs the status signals that define the current machine cycle for all devices attached to the bus. The status latch was used in the 8800b instead of the 8228 bus controller because it was necessary to maintain bus compatibility with the original Altair 8800.

The majority of the system bus lines either originate or terminate at the CPU board. All output lines from the board are driven by tri-state bus drivers (74367 or 74368).

ADDED BUS LINES

All of the original Altair 8800 bus lines have been maintained, and five new lines have been added:

Bus Number	Signal
12	XRDY2
58	FRDY
55	RTC
56	STSTB
57	DIG1

POWER SUPPLY

Specifications: The power supply furnishes the following voltages to the 8800b bus at the indicated full load currents.

8 volts at 18 amps
+18 volts at 2 amps
-18 volts at 2 amps

The +18 and -18 volt supplies are pre-regulated (series pass transistor) to provide a constant voltage to the bus over the load range of the supplies (0-2 amps).

The +8 volt supply is not pre-regulated. Instead, the 8 volt secondary of the transformer is tapped at 3 points. By changing the tap that drives the 8 volt supply, the bus voltage can be maintained between 7.5 volts and 9 volts over a load range of 1 amp to 18 amps.

The primary of the power transformer is tapped to allow for either 115 volt AC or 230 volt AC operation. In addition there are "HIGH LINE" and "LOW LINE" taps for 130 VAC, 100 VAC, 260 VAC and 200 VAC operation. The supply will operate at the above specifications on either 50Hz or 60 Hz line frequencies.

18-Slot Motherboard

The four-slot expander cards in the Altair 8800 have been replaced by a single piece 18-slot motherboard. The 18-slot motherboard contains 100 solder lands which comprise the 100 pin bus. The need for expander board wiring has been completely eliminated. Assembled units may be ordered with 6, 12 or 18 edge connectors.

Single Step/Slow

Single Step: The 8800b has provisions for selecting one of two modes for the single step operation by means of a patching jumper. In the first mode a single machine cycle will be executed each time the switch is activated. The second mode allows a complete instruction cycle to be executed.

Slow: The SLOW mode on the 8800b will operate in the same manner as single step as far as the mode is concerned. The speed of the slow mode is selectable by patching jumpers for three different speeds.

Data LEDs

The front panel data LEDs are driven (in the STOP mode) by the Data Out Lines (DO0—DO7). (In the Altair 8800 they are driven by the Data Input Lines, DI0—DI7.) If you are operating single step in the single machine cycle mode, this enables you to see the correct data on the LEDs during memory write and output machine cycles.

RESET Switch

The RESET switch on the front panel has provisions for wiring to the front panel switch enable line (instead of to ground). If this is done, the machine can be RESET only in the STOP mode.

Control PROM

The front panel control PROM has been divided into 16 sectors, each 16 bytes long. The even addresses within any sector are used to control the front panel circuit. Since the last address must contain a stop code for the PROM Address Counter, there are 7 bytes available in each sector for machine code. This means that there is some flexibility in redefining the front panel switch functions (for special applications) by re-programming the control PROM. The functions are constrained by the fact that there are only 7 bytes of machine code available to execute them. ▯

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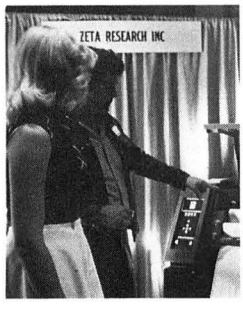

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BASIC

Writing machine language programs for your microcomputer can be an extreme pain below the neck. Unfortunately, your micro cannot converse in the language you know. The compromise is a language similar to English that the computer can translate into machine instructions it knows how to respond to.

BASIC is one of the easiest programming languages to learn. It allows you to write simple declarative statements the computer interprets into machine language instructions. It has the additional advantage of permitting you to manipulate strings of text with your computer.

This tutorial is a first look at BASIC for readers totally unfamiliar with the language. It consists of two articles. This article starts the discussion, introduces you to the elements of the language, and provides a program writing assignment.

You will be able to judge your familiarity with the subject when INTERFACE publishes the second article in this series.

George Hockney, Cal State Long Beach programming whiz, has promised a tutorial on one of the principle advantages of BASIC in a future issue of INTERFACE. We have to get the basics of BASIC first so that we can understand what he teaches us.

Let's use the expression $E = IR$ to write a very short program and get the discussion started. When we use this expression, we multiply some I value by some R value and write it down as the value of our voltage, E. We want the computer to do the same thing and a little bit more.

Specifically, we want the computer to input a value for I and a value for R. We want it to let the variable E equal IR, and we want it to print E. Figure 1 shows a program that will do this.

Notice how much similarity there is between program lines and simple English sentences that describe the desired operations. Notice three more things:

1. Each line of the program has its own identifying number.
2. The symbol on line 30 represents multiplication. The conventional multiplication symbol, ×, is avoided to prevent confusion with the variable X of X and Y.
3. The "End" statement is on line 50. The computer executes each line in numerical order, and stops execution when it sees the "END" statement.

If we ran the program shown in Figure 1, it would input one current value, input one resistance value, print one voltage value, and end. It would have very little worth. We would have to start the program over each time we wanted one voltage value. What we need here is some simple program modification that would permit the computer to calculate several values.

```
10    INPUT I
20    INPUT R
30    LET E = I*R
40    PRINT E
50    END
```

FIGURE 1

We can calculate an unlimited number of voltage values by making the computer go to line 10, and start over after each execution of line 40. All we have to do is add one line, as shown in the modified program of Figure 2.

Notice again how straight forward the BASIC language is. We make the computer go to line 10 by simply writing GO TO 10. We make it do so after the execution of line 40 by assigning the GO TO line a number between 40 and 50. We do not usually use the next consecutive number for the same reason we did not use adjacent numbers in Figure 1. We might want to add some new line between the PRINT and the GO TO statements before we finish the program.

The program shown in Figure 2 will crank out voltage values endlessly. Every time we input a current and resistance, it will print a voltage and ask for a new input.

```
10    INPUT I
20    INPUT R
30    LET E = I*R
40    PRINT E
45    GO TO 10
50    END
```

FIGURE 2

The computer asks for input by printing a ? The user responds to the ? by typing the input value and hitting the return (RET) key. The dialogue between the computer and the user is shown in Figure 3.

Figure 3 shows two complete passes through the program and the start of a third pass. The input requests from the computer are identical. It would be easier on the user if the computer told him what kind of information to input and the related unit of measure. The computer would provide additional information if it told the user the unit of measure for the output.

An Easy Programming Language

By Bruce A. Scott

```
COMPUTER          USER
?                 2 (RET)
?                 50 (RET)
100
?                 8 (RET)
?                 25 (RET)
200
?
```

FIGURE 3

Once again, the changes are easy to make. Figure 4 shows one way to change the program and one pass of the modified program.

Notice the unnecessary *I*(AMPS)=? print below *E*(VOLTS)=100 in Figure 4. We created a monster when we added the unconditional GO TO statement at line 45. Lines 5 through 45 comprise a serious programming error called an *endless loop*.

I haven't intentionally misled you. The endless loop served a purpose here, so we used it. What we want to avoid at all costs is the unintentional endless loop that will dominate the computer and prevent it from completing the intended program.

Suppose that you have written yourself into a corner. Imagine that your program includes an endless loop, and that the program is running. Your problem is how to escape from the loop.

```
LIST
    5   PRINT "I(AMPS)=";
   10   INPUT I
   15   PRINT "R(OHMS)=";
   20   INPUT R
   30   LET E = I*R
   40   PRINT "E(VOLTS)=";E
   45   GO TO 5
   50   END
RUN
    COMPUTER                USER
    I(AMPS)=?               2 (RET)
    R(OHMS)=?               50 (RET)
    E(VOLTS)=100
    I(AMPS)=?
```

FIGURE 4

There are two common ways to escape from a running program. The first way is easy to remember. You hit the escape (ESC) key. The second way is not so obvious. You have to type a control C. You do this by holding down the control (CONT) key and hitting the C key. The way that is appropriate for you depends on the software available. Check your software support information and know the answer when you run your program.

Okay. That's what you do when you are in a running endless loop. It is far more practical to avoid the loop while you are writing the program.

Let's modify the program we're writing to eliminate the unconditional GO TO. One possible modification is based on the thought that there are some numbers, 123456 for example, that we would be surprised to find in our data. The probability that some number won't occur as data and the fact that we can type any input provides one simple way to run the program until we want the computer to do something else. We call the special number a *flag* and modify our program by adding a line which tells the computer to look for the flag. We tell the computer that if the flag is the input value then go to some line outside the loop. We call the instruction the IF-THEN, as shown in Figure 5.

```
   13   IF I = 123456 THEN 48
   48   PRINT "LOOP EXITED ON FLAG"
RUN
    COMPUTER                USER
    I(AMPS)=?               2 (RET)
    R(OHMS)=?               50 (RET)
    E(VOLTS)=100
    I(AMPS)=                123456 (RET)
    LOOP EXITED ON FLAG
```

FIGURE 5

Notice we did not retype the program. We typed the new lines and ran the program. The BASIC interpreter tucked the new lines in where they belonged and then ran the program as though they had always been there.

There is another solution to the endless loop. This one is based on the thought that we can arrange our input values into neat sets of some predetermined quantity, say 10. We add a statement to the program that tells the computer to loop through the routine ten times and then exit automatically to do something else. If we modify our program this way, it looks like Figure 6.

The modification to the program is on lines 3 and 45.

```
LIST
    3   FOR N = 1 TO 10 STEP 1
    5   PRINT "I(AMPS)="
   10   INPUT I
   13
   15   PRINT "R(OHMS)="
   20   INPUT R
   30   LET E = I*R
   40   PRINT "E(VOLTS)=", E
   45   NEXT N
   48
   50   END
```

FIGURE 6

Run together, these two lines read FOR $N = 1$ to 10 STEP 1 NEXT N. They mean that the computer should start with some variable N equal to 1 run down to line 45 and branch back to line 3. At this point, the computer is instructed to add 1 to N by the instruction STEP 1 and take another pass at it. Finally, the computer is told to keep doing this until N is equal to 10. This sequence is called the FOR-NEXT pair.

Notice also that line numbers 13 and 48 are shown in Figure 6 without any statement. These line numbers were used in the previous modification. We have no further need for them with the FOR-NEXT pair in place so we eliminate them by typing their line numbers and hitting the return key. Typing a new line with a previously used line number replaces the original line with the new one of the same number.

The modification shown in Figure 6 is based on the thought that we know the quantity in our data set. We may not know the quantity, and we may want to write the FOR-NEXT pair in a way that permits us to change the number of passes, or iterations, that we need through the loop. All we do is make the end point of the FOR-NEXT pair a variable. And add a line to set the variable at the time that the program is used. These two lines are shown in Figure 7.

```
    2   INPUT "HOW MANY DATA SETS", M
    3   FOR N = 1 TO M STEP 1
```

FIGURE 7

Line 2 in Figure 7 incorporates a feature called the *implied print statement.* This statement combines the action of a print statement with the action of an input statement. With this feature in mind, we can clean up our program by combining the print statements into the input commands. The result is shown in Figure 8.

```
    2   INPUT "HOW MANY DATA SETS", M
    3   FOR N = 1 TO M SETP 1
    5
   10   INPUT "I (AMPS)=", I
   20   INPUT "R (OHMS)=", R
   30   LET E = I*R
   40   PRINT "E(VOLTS)=", E
   45   NEXT N
   50   END
```

FIGURE 8

Let me make several points that are important to your programming. Line 13 used = for the conditional branch. There are six comparatives that you can use. They are listed in Figure 9.

The only symbol in Figure 9 that may cause you difficulty is the *not equal to* sign. Check the software support information that comes with your BASIC interpreter. Some interpreters use # for not equal to.

SYMBOL	EXAMPLE	SIGNIFICANCE
=	B = A	B EQUAL TO A
<	B < A	B LESS THAN A
>	B > A	B GREATER THAN A
<=	B <= A	B LESS THAN OR EQUAL TO A
>=	B >= A	B MORE THAN OR EQUAL TO A
<>	B <> A	B NOT EQUAL TO A

FIGURE 9

Line 30 uses * to call for multiplication. There are five mathematical operators. They are listed in Figure 10.

Final point: Standard BASIC limits the variable to one letter followed by one digit. LET B9 = 14 is acceptable. Let BC = 14 is not acceptable. Incidentally, LET H1 = H1 + 14 may look funny but it is acceptable. It means replace the value currently known as H1 by adding 14 to it.

SYMBOL	SIGNIFICANCE	EXAMPLE
+	ADD	2 + 3 = 5
–	SUBTRACT	3 – 2 = 1
*	MULTIPLY	2 * 3 = 6
/	DIVIDE	3 / 2 = 1.5
↑	EXPONENTIATE	2 ↑ 3 = 8

FIGURE 10

At this point, you have enough information to start writing your own programs. Let me give you a writing assignment to complete before you read the second of this series in INTERFACE.

ASSIGNMENT:

Capacitive reactance is calculated from the expression

$$X = \frac{1}{2\pi fc}$$

Write a program that will:

1. Input F in Hertz and C in Farads and calculate X (Warning: avoid division by zero).
2. Print Frequency, Capacity, and Reactance with appropriate units of measure.
3. Use an IF-THEN flag to loop through the program (Hint: There are no frequencies less than zero).

Let me wish you the best of luck in your writing efforts. I hope that you find program writing as much fun as I do.

Let me ask you for your help. These tutorial articles are written for your enjoyment and edification. I push them through an able technician and modify them to his suggestion before publication. Still, the possibility, maybe the probability, exists that I am missing my mark. Please drop me a post card if you can provide any creative criticism. Let me know of any aspect of computer technology you would like to see as a tutorial. Tell me anything that you think will help me inform you and the other readers. ◻

Respectfully,
Bruce A. Scott

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Comparison of the Zilog Z-80, Intel 8080, and Motorola 6800CPU chips

	Z80	*8080*	*6800*
NUMBER OF:			
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Internal Registers	17	7	6
Addressing Modes	10	7	8
Voltage Required	+5	+5,–5,+12	+5
Standard Clock Rate	DC-3MHz	0.5-2MHz	0.1-1MHz
Clock Phases	1	2	2
Clock Voltage	4.2	8.4	4.8
DynamicRAM refresh and timing signals without slowing down CPU or requiring additional circuitry	Yes	No	No
Single instruction memory to memory and memory to I/O BLOCK TRANSFERS	Yes	No	No
Single instruction SET, RESET, or TEST *of any bit in accumulator, any general purpose register, or any external memory location*	Yes	No	No
Single instruction BLOCK SEARCH of any desired length of external memory for any 8-bit character	Yes	No	No
Non-Maskable Interrupt and TTL compatible inputs	Yes	No	Yes
Internal sync of inputs and direct strobe of outputs	Yes	No	No

* Includes all 78 machine code instructions of the 8080A and is therefore capable of running any standard 8080A software without modification.

ADDITIONAL FEATURES OF THE Z-80:

- Up to 500% more throughput than the 8080A
- Requires 25% to 50% less memory space than the 8080A CPU
- Three modes of fast interrupt response plus a non-maskable interrupt
- Outperforms any other microcomputer in 4-, 8-, 16-bit applications

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CIRCLE NO. 10 ON INQUIRY CARD

'76 PERSONAL COMPUTING OR BUST

by R. S. Jones

John Dilks doesn't come off like a promoter, but he's obviously pleased with what he's done on a short budget—an idea, good timing, and a lot of confidence in what he's pretty sure will be *the* personal microprocessing event of this year's social season.

Personal Computing '76 will be held at Atlantic City's Shelburne Hotel August 28-29, and will probably be what Dilks hopes for; a grand array of hardware, exhibits, seminars, and software lectures forming up his and several other's personal testament of where luck and faith can lead.

Dilks and his assistants have been working on the idea of a personal computing show for close to a year, and after the success of the Trenton Computer Festival in May, let the idea run full out, taking the plunge without wondering why. There hasn't been the time.

The Trenton Festival opened May 2 at 10 a.m. By 10:15 a.m., it was jam-packed and obvious the organizers hadn't realized just how many people had become involved in the field. Enthusiastic fans effectively prevented any serious klatching between exhibitors, and that's where this show will be different, says Dilks.

"This was originally planned as a consumer show, but after Trenton, we decided to include opportunities for the serious computerists to get together and exchange some information, not just sales literature and souvenirs."

The convention, as he likes to think of it, will include more than just exhibitions, with lectures, seminars, and free time for personal projects.

He points out the rapid expansion of the microprocessing industry has created a serious shortage of software, with many wanting into more sophisticated programs, but unable to work out the basic problems.

"Much of the equipment on the market comes from what often began as a mom and pop type company," he says, "and of course, there are problems. These entrepreneurs aren't necessarily business people."

He goes on to say that many of these small operations don't have access to national advertising, and the home computerist with a few dollars to play with can't get a really comprehensive view of what's availa-

ble and what it's about.

That's where we've got most of the bases covered," he remarked. "The high-priced items have dominated the field until now, and what we're seeing is a resolution not unlike hand computers over conventional business machines."

Manufacturers have been incredibly cooperative, he reports, the most frequently heard opening line being, "How can we help you?"

Even at this writing, little more than a month before the opening, John hesitates to be nailed down as to exactly *what* will be featured, but gives an idea of what to expect.

Speakers and seminars will include Bob Sudding, among others, on the use of the new Z-80, David Ahl on graphics and games, Hal Chaimberlain on computer music, and Carl Helmers of "Byte" lecturing on standardization.

The American Radio Relay League will have a program on computer hamming, and Amsat will be there for a presentation on satellite positioning.

Closing speaker will be Ted Nelson, author of "Computer Lib."

Commitments have been received from "just about everybody," Dilks says, and will include exhibits of the latest equipment from Mostek, ENL, Cromemco, MOS Technology, MITS, SWTP, RCA, IMSAI, SPHERE, IBM, TDL, and TSC. Many of these companies have donated doorprizes, including entire systems.

One of the more interesting seminars will feature Dr. Dick Moberg of Philadelphia's Jefferson Medical School, and Dave Jones of Somers Point, NJ, on medical applications of microprocessing.

Jones has been working in the area of the computer-regulated administration of insulin, while Moberg has leaned towards a computer-controlled artificial pancreas.

Jones has been blinded by diabetes, and became particularly interested in the artificial pancreas idea when his infant daughter was stricken with the disease.

Despite his handicap, Jones has been Dilk's right-hand man in setting up the show, making and taking calls at all hours, wheedling commitments, supervising mailings, and providing a good-natured wife to staff the telephones when he can't.

Dilks also credits friends Jim Main, Chuck Naylor and Denise Casper as his expeditor, graphics and bookkeeping departments, functions which sometimes blur together, he says.

Much help and encouragement has come from the Southern Counties Amateur Radio Association and the Amateur Computer Groups of New Jersey, he adds.

What happens after this?

Dilks is already planning the '77 affair, at a yet undecided place and time. He hopes to have most of the organizational debugging completed.

"It's going to work," he insists, and from all appearances, it will. "Sure, there've been some problems, but what do you want from a kid who started it all off many years ago with a five-watt transmitter?"

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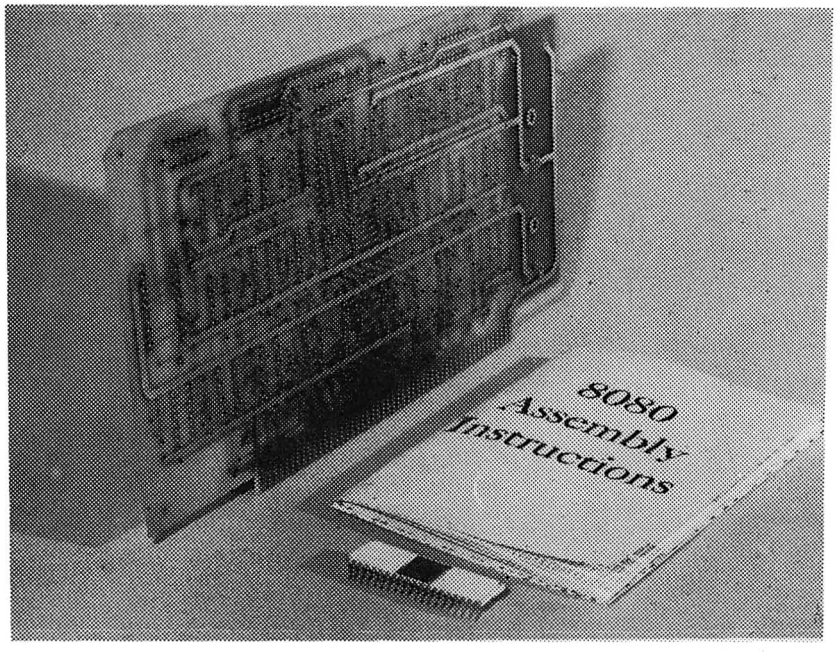

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CIRCLE NO. 17 ON INQUIRY CARD

New Products

iCOM Introduces Low Cost OEM/Hobbyist-Oriented Microprocessor Floppy Disk Sub-System

A low cost, high performance Floppy Disk Sub-system, specifically designed for OEM or hobbyist microprocessor based systems, has been introduced by iCOM Inc.

Model FF-36, referred to as the Frugal Floppy[tm], employs the same elements as iCOM's field-proven FD360 system. However, by eliminating expensive cabinetry, power supply and system assembly labor, iCOM can offer the FF-36 for $996 in small OEM quantities.

Basically, the FF-36 contains a Model CF360 Controller/Formatter, a Floppy Disk Drive with daisy chain capability, and all required connectors and cables. The unit can be supplied as a single (FF-36-1) or dual (FF-36-2) drive system.

iCOM's IBM compatible CF360 Controller/Formatter, already in use in hundreds of systems, provides auto track and sector seek/verify, full sector I/O buffers and auto CRC generation & checking. The controller can handle up to 4 drives with no changes in hardware or software.

Available as an option is iCOM's powerful FDOS-II software package, designed for any 8080 or 6800 based system. The FDOS-II software, which features named variable length files, auto file create, open & close, multiple merge & delete, can be used either in development systems or application packages.

FF-36-1 is priced at $995 in small OEM quantities or $1195 for a single unit. Delivery is two to three weeks.

For further information, contact Terry Zimmerman, Vice President of Marketing, iCOM Inc., 6741 Variel Avenue, Canoga Park, CA 91303, (213) 348-1391.

CIRCLE NO. 90 ON INQUIRY CARD

Low-Cost Microcomputer System Makes Learning Microprocessors Easy

A new educational microcomputer system, based on the 8-bit 8080A microprocessor, designed for classroom instruction or home study for people with no previous experience in computer programming and only a fundamental knowledge of electronics.

The Mini-Micro Computer (MMD-1) from E&L Instruments, Derby, Conn., includes all the hardware, firmware and easy-to-understand instructions necessary for learning basic microcomputer programming and interfacing. The course organization emphasizes the role of the microprocessor in machine and process control applications.

A completely assembled and tested MMD-1 ready for use sells for $500 each. In kit form with all parts ready for assembly, the price (including all instructional materials) is $350. For further information, contact E&L Instruments Inc., 61 1st St., Derby, CT 06418, (203) 735-8774.

CIRCLE NO. 91 ON INQUIRY CARD

TMK-132B Changes ASR-33 Teletype from 72 to 132 Print Positions

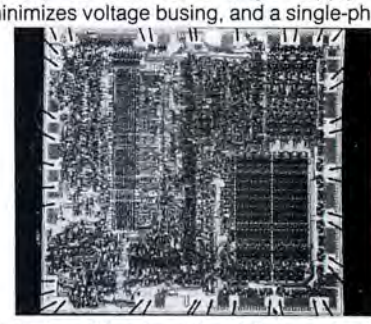
Easier, faster installation and reduced price are features of the new model B modification kit. A new print cylinder with narrow san serif characters is supplied along with hardware to increment 132 positions on a standard TTY 8½" platten.

The technique for accomplishing this has been simplified so that installation time is now just 15 minutes. The carbon ribbon supplied with the kit causes the print-out to be extremely crisp and legible. Tests have proven that the carbon ribbon lasts 50 percent longer than the standard nylon ribbon. The improved incrementing technique has proven to be extremely reliable in thousands of hours of testing. Further information may be obtained from TTS, 2928 Nebraska Ave., Santa Monica, CA 90404.

CIRCLE NO. 92 ON INQUIRY CARD

Z80 Chip Offered by Mostek

The new Z80 microprocessor CPU from MOSTEK replaces the equivalent of three circuits in the 8080A up, with only a 10 percent increase in chip size. Size has been minimized through use of a sophisticated internal bus structure, totally new architecture, a high-speed, four-bit ALU, a single supply that minimizes voltage busing, and a single-phase



clock. In addition to a 25 to 50 percent reduction in memory requirements and a 25 to 100 percent increase in throughput, the MOSTEK Z80 provides more than twice the number of instructions of the 6800 or the 8080A. The original 78 instructions and OP codes of the 8080 are part of the Z80's instruction set. For more information contact Mostek Corporation, P.O. Box 169, 1215 West Crosby Road, Carrollton, Texas 75006, (214) 242-0444, Telex 730423.

CIRCLE NO. 93 ON INQUIRY CARD

Texas Instruments Announces Additions to 9900 MP Family

Texas Instruments Incorporated will add a new microprocessor and four peripheral circuits to its TMS 9900 family.

The TMS 9980 is a new MOS microprocessor—a lower performance version of the powerful 16-bit TMS 9900 microprocessor. It is packaged in a 40-pin DIP, and executes the full 9900 instruction set including hardware multiply and divide.

The TMS 9901 is a programmable systems interface using NMOS technology. It can be used with 9900 or 9980 systems. The 9901 interfaces directly to the processor CRU port, and provides three functions—interrupt prioritization, I/O control and interval timing.

The TMS 9902 is an NMOS asynchronous communication controller (UART) which can take advantage of the CRU I/O port of the 9900 and 9980.

The TMS 9903 is an NMOS peripheral which performs the synchronous communication control, and also interfaces to the 9900 and 9980 via the CRU I/O port, which allows it to be packaged in a 20-pin 300 mil DIP.

The TIM 9904 generates four TTL-level clock phases to drive the other support chips (9901, 9902, 9903). Samples of the TIM 9904 will be available in the third quarter.

Pricing on all five new parts will be announced when samples are available.

For further information, contact Texas Instruments Inc., P.O. Box 5012, MS/84, Dallas, TX 75222, Attn: "9900 Family."

CIRCLE NO. 94 ON INQUIRY CARD

Simple Gang Terminal Insertion Tools Speed Installation

A new line of gang terminal insertion tools, from Vector Electronic Company, allows fast in-line insertion of multiple terminals with a single press operation. The tools, designated Models P188 to P198, accommodate various types of terminals which previously required individual installation. The tools permit insertion rates from 500 to 1200 terminals per

hour. For prototype or low-volume production, terminals are hand inserted loosely into the circuit board, or into the tool.

The tools are used in conjunction with Vector's P186-1 Arbor Press and alignment blocks appropriate to the hole spacing in the circuit board.

For more information contact Floyd Hill, Vector Electronic Company, Inc., 12460 Gladstone Avenue, Sylmar, CA 91342; (213) 365-9661, TWX (910) 496-1539.

CIRCLE NO. 95 ON INQUIRY CARD

E & L Instruments Offers Its 1976-1977 Catalog of Electronic Circuit Design Aids

A 26-page catalog of electronic circuit design aids from sockets and bread-boards to complete educational systems is now available from E & L Instruments, Inc., Derby, Conn. The new Circuit Design Line catalog includes more than 180 different products for everyone who builds electronic circuitry.

Products from E & L Instruments assist the professional designer in circuit development, help the student to understand electronics, bring the latest in technology to the hobbyist and aid the scientist in applying electronics to experimental apparatus.

Copies of the Circuit Design Line catalog are available from E & L Instruments, Inc., and its representatives.

For further information contact Richard Vuillequez, E & L Instruments Incorporated, 61 First St., Derby, CT 06418, (203) 735-8774.

CIRCLE NO. 96 ON INQUIRY CARD

Improved Power Supply for Altair 8800 Offered

Parasitic Engineering is now offering a constant voltage power supply kit for the Altair 8800. It's designed to make the Altair almost immune to unreliable performance due to power line fluctuations. The power supply delivers full output (8 volts at 12 amps, plus or minus 16 volts at 1 amp) even when

the line voltage is as low as 90 volts. It also provides increased isolation from line noise and excellent over-voltage protection. The output rises less than 2% with an increase in line voltage to 130 volts.

The power supply kit is available for $75 postpaid (California residents add $4.50 tax) and comes complete with all necessary components and step-by-step instructions for easy installation. A descriptive brochure is also available. Write to Parasitic Engineering, P.O. Box 6314, Albany, CA 94706.

CIRCLE NO. 97 ON INQUIRY CARD

Info-Tech Introduces New KSR Type Terminals

Two new KSR type terminals have been developed by Info-Tech, Inc., St. Louis manufacturer of digital electronic systems for the amateur radio market and light computer use. According to the manufacturer, these new products are two of the lowest priced of their type in the electronic industry.

One terminal features 16 lines of 32 characters; the other 16 lines of 64 characters, both with RS 232 compatibility. They also interface with all popular micro-computer kits and any video monitor. Detailed technical information and prices on the new terminals can be obtained by writing Info-Tech, Inc., 20 Worthington Drive, St. Louis, MO 63043, (314) 576-5489.

CIRCLE NO. 98 ON INQUIRY CARD

16k Memories Bring 21MX Cost down 24%

Using 16k memory modules with 18-pin 4k RAM's, the 21 MX minicomputers can contain twice as much memory as earlier 8k

memory modules using 22-pin RAM's, says the manufacturer. The modules are priced 30% lower than earlier versions, and directly affect systems pricing. For example, a 16k 21MX computer is now available to large OEM's for less than $4521; a 256,000 word 21MX mini costs a little over $30,000; according to H-P, 24% less than a machine of the same size with the earlier 8k memory modules. (13187A, 16k module, $2100; *16k 21 MX computer, $4521;* 32k machines, $5907; 64k machines, $10,725—8 weeks.) For more information contact Hewlett- Packard.

CIRCLE NO. 99 ON INQUIRY CARD

Texas Instruments Introduces Three Static RAM Circuits

Texas Instruments Incorporated today announced three new static random access memory (RAM) circuits that enlarge its line of NMOS/1K memory support devices.

Organized 256 X 4, the three new RAMs are ideal for 4, 8 or 16-bit microprocessor based systems. Each type comes in three speed ranges, 1,000, 650 and 450 ns maximum access and read and write cycle times.

They operate from single +5 volt supplies and are fully TTL compatible. A three-state output and chip enable makes memory expansion simple. Typical power dissipation is only 175 mW.

The three RAMs and their features are:

- TMS 4039/2101, with 22 pins, has separate input and output, output enable and two chip enables;
- TMS 4042/2111, with 18 pins, features bus oriented common I/O, output enable and two chip enables; and
- TMS 4043/2112, with 16 pins, offers common I/O and chip enable.

Prices in 100-piece quantities for parts in plastic DIP (with N suffix) range from $3.00 for devices with 1,000 ns maximum access times to $3.25 and $3.80 for those with 650 and 450 ns access times respectively.

For further information contact Bill Phares, (713) 494-5115, at Texas Instruments Incorporated, Inquiry Answering Service, P.O. Box 5012, M/S 84 (Attn: 1K RAMs), Dallas, Texas 75222

CIRCLE NO. 100 ON INQUIRY CARD

Put a 6800 MPU in Your Altair

M. R. S. has developed a high quality Microcomputer card primarily designed for an Altair 8800 or IMSAI 8080 Microcomputer.

The addition of an AM6800 Microprocessor Card to an Altair 8800 or IMSAI 8080 gives both unbeatable flexibility and computing power.

It is a one board pin compatible card for an Altair 8800 or IMSAI 8080. No modifications are required and it will not interfere with normal execution of 8080 programs. The MC6800 gains control via software command, one instruction. You can return control by either the front panel stop switch or through software, one instruction. It will operate with either fast or slow, static or dynamic memories. The MC6800 MPU status signals are brought out on unused bus lines (jumper option), i.e., 01 & 02 clocks, VMA and R/W lines for system development. The 8080 processor card remains in the computer to handle all front panel controls. All data and address lines are three-stated buffered.

Prices

AM6800 CKT, complete kit with 6800 MPU, assembled and tested—$180.00

AM6800 CK, complete kit with 6800 MPU—$130.00

AM6800, complete kit except 6800MPU—$97.75.

SCHEMATICS, available on request for and refundable upon purchase—$2.00.

For further information contact, M. R. S., P. O. Box, 1220, Hawthorne, CA 90250

CIRCLE NO. 101 ON INQUIRY CARD

Microprocessor Software/Hardware Development System Provides Floppy-Disc Performance at Half the Cost

Processor Applications Ltd., introduced a new concept in microprocessor design tools. Tagged the μPAL2650, the system boasts performance comparable to floppy-disc based systems at about one-half the cost. The system presently supports the 2650 microprocessor, however, future offerings will include software to support other popular microprocessors available today.

The μPAL 2650 is expandable to meet the user's needs and is available from stock, FOB West Covina, California. For further information contact Processor Applications Ltd., 2801 East Valley View Avenue, West Covina, California 91792, (213) 965-8865.

CIRCLE NO. 102 ON INQUIRY CARD

Exclusive Directory of Remote-Access Packaged Software

Gregory Research has compiled a complete directory of all the thousands of pre-packaged computer programs and data-bases in every field available from hundreds of low-cost time-sharing sources to anyone with "hunt & peck" typing ability, an inexpensively rented typewriter style data terminal and a telephone. No computer programming ability is required as all the programs and data-bases use an English language, question and answer technique.

Broad areas such as accounting, design, economics, education, engineering, finance, insurance, management, manufacturing, marketing, math, personnel, physics, planning, real estate, scheduling, statistics, stocks & bonds, structural analysis, taxes, transportation and so forth are indexed.

RCPD is available on a mail-order basis with the first three bi-monthly updates included in the postage pre-paid cost of $28.00. For more information contact Gregory Research Associates, 1900 Greymont Street, Phila., PA 19116.

CIRCLE NO. 103 ON INQUIRY CARD

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F8 is a family of LSI Integrated Circuits in a carefully planned architecture of ascending power and versatility. It solves logic and control problems the way engineers want. For more information contact Fairchild Micro Systems, 1725 Technology Dr., San Jose CA, 95110, (408) 998-0123.

CIRCLE NO. 104 ON INQUIRY CARD

IMSAI 8080

PRODUCT REVIEW:

IMSAI 8080 — MacHINERY

By S. A. Cochran, Jr.
Attorney at Law
Tyler, Texas

As an attorney, I am a little out of my field messing around with computers. However, my life was not untouched by the manifestations of the computer age; about four years ago I had a mag card selectric typewriter on lease from IBM and was struck with the convenience—and high cost—of mechanized typewriting.

More recently, I heard that two neighbors, John Arnold and Dick Whipple, were assembling a computer for peanuts compared to the tariff levied by IBM for its typing units, let alone its computers. In the hope that I could, in this manner, assemble a power typing system with greater capabilities than anything I could expect to get from IBM, and at far less cost, I jumped into the microcomputing stream. John Arnold generously lent me his help and workshop to assemble my unit.

Last January, I decided to get an IMSAI because at that time IMSAI was offering about the same type system that Altair offered, plus a 1K memory board. Then, the prices for Altair memory were substantially higher than those of IMSAI. Although IMSAI's prices have increased since then, the advantage on the price of memory still appears to hold.

ASSEMBLY

I placed my order for the basic IMSAI unit on January 22nd and received it on February 5th. Because I placed a supplemental order for

additional memory and a number of other boards on January 25th, I was unable to proceed beyond construction of the cabinet and the individual modules in February. However, I was able to check these out on John's Altair. I had no serious problems in assembling these units in spite of my amateur status with electronics assembly.

When the second module of memory and other parts arrived on March 8th, I was able to complete the assembly of MacHinery, again with no serious problems.

During the original assembly, I had only two points where I seriously thought I'd lost the load. Once, I had switched a 25 mfd capacitor for an 0.1 mfd bypass capacitor, thereby shunting all signals into memory direct to ground. In the second case, vigorous shaking of the front panel dislodged a capacitor lead that had fallen afoul of one of the front panel switches.

I/O BOARD

The arrival of the serial input/output board for this equipment, originally ordered in January, was delayed by a considerable redesign which must have started in January, and was probably concluded at the end of February. The documentation I have received with the original equipment showed the assembly of the S102-2 board, revision 1. I received at least one set of errata with the documentation. Another set of errata arrived after I had received the equipment. Ultimately, IMSAI sent me their S10 2-2 revision 3 board, with all changes mentioned in the errata built into the board.

I/O DEVICE SELECTION

John Arnold, Dick Whipple and I joined in the acquisition of three Burroughs Model #9350-2 communicating typewriters from Herback and Rademan of Philadelphia. These units were correctly advertised as receiving and transmitting a form of ASCII. They appear to be based on the Friden Model 2300 typewriter, a modernized version of the Flexowriter, and can be used as a computer printout device. This model is not readily convertible to use as a computer input because of direct mechanical linkage between the keyboard and the keybars of this "typewriter." It was also hard to get accustomed to the fact that this unit has no backspace key! Additional major maintenance was to be done on the equipment, though it could be induced to type. Thus far, I haven't been able to get the typewriter hooked up to the computer and running.

KEYBOARD

After making the decision to use an outboard keyboard unit for input to the computer, I bought one of the keyboards originally built for RCA from Sargent's in Los Angeles. This keyboard unit was advertised to be fully ASCII encoded, and it was, so far as it went. It had provision for upper and lower case letters, numbers and punctuation marks, but unfortunately did not have provision for non-printing control characters which are used in BASIC and other computer languages. When power was applied to the keyboard, we discovered it carried a strobe that was valid as long as the key was pressed, and used negative logic. That is, the strobe output, and all the other outputs affected when a key was pressed, went from a voltage of 5.0 to 0.4 volts.

With these two problems to solve,

BRANCH to . . . pg. 60

HARDWARE REPORT

By Scott Wilcox

Having a working computer these days is not too difficult with the availability of the current crop of fine chips on the market. Input/output is generally the area of greatest concern from a hardware point of view. System efficiency and data through-put are directly related to the I/O structure.

When data is transferred between (micro) computer and an input/output device, several things must happen almost simultaneously. First, the microcomputer must select the specific I/O device that will either receive or transmit the data bits, and the processor must indicate to the specific I/O device when the bidirectional data bus is available for data transmission. Last, the data must be transmitted between the microcomputer and the input/output device in a very short period of time, typically on the order of microseconds.

When data is exchanged between the accumulator and an external I/O device, this is referred to as an accumulator I/O. It is something of a disadvantage to have this type of interfacing architecture, in that only a single origin and destination for data exists; the accumulator. Typical microprocessor chips have a variety of internal registers, in addition to the accumulator, that can exchange information with memory locations. From a programming standpoint, it would be very desirable to exchange data between any of these registers and an external device.

To exchange data between a general purpose register and an external I/O device, an interfacing technique is used called Memory I/O or Memory Mapped I/O. The trick to this approach is to treat the I/O device as if it were one or more memory address locations. Doing this, you automatically create new I/O instructions, such as MOV,STAX,LDAX,SHLD,LHLD,STA, and LDA, in the 8080 instruction set which transfers data between registers and memory locations.

The differences between accumulator I/O and memory I/O can be seen in two connections possible for an INTEL 8255 programmable peripheral interface chip. This chip has 24 I/O pins grouped as PA,PB,PC which appear to a microprocessor as four memory locations (including one control port address). The registers within the 8255 are addressed by the processor as follows:

1. Port A is an 8-bit port that can be configured as either an input or an output port or may function bidirectionally.
2. Port B is an 8-bit port that can be configured as either an input or an output port.
3. Port C is an 8-bit port that can be configured as an input port or an output port, or as a pair of control ports, one for port A and the other for port B.

4. An 8 bit control port is accessible to the CPU to determine the specific I/O configuration of the 8255, and may be changed at any time.

As can be seen from Figure 1 and 2, the only difference in the chip connections is for control inputs CS, RD, and WR.

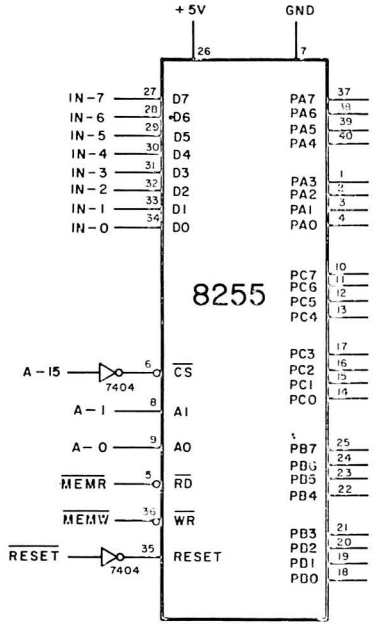

Figure 1
Memory I/O Interface Connection.

For memory I/O, signals MEMR and MEMW, the normal *memory read/write* function pulses transfer data to the 8255 memory locations. Any of the 16 memory address bus lines may be used to address the chip. In this case, only bits A0, A1, A15 are used to select and enable the chip. Using 8080 machine language, to output from register D to port A:

061_8 set I/O memory address
000_8
200_8
162 move register D to output port A

Successive outputs to port A require only further execution of instructions such as:

160^8 move register B to output port A
163_8 move register E to output port A

This assumes, of course, that the data desired to be output is in the registers in question. These additional transfers require only 2 microseconds each.

In accumulator I/O, the CPU status lines IN and OUT control reading and writing into the 8255 chip. The chip is again selected and enabled by address lines which, in this case, hold the I/O device address. In figure 2, A0, A1, A7 define the four different registers within the chip. Here an accumulator I/O data transfer would be:

323_8 enable port A and allow data to be accepted from the accumulator
200_8 device code for port A

Changing the OUT 200 instruction to an IN 200 instruction causes the CPU to read data from port A.

333_8 enable port A and allow data to be sent to the accumulator
200_8 device code for port A

The specific application will determine the best I/O technique. In some cases, accumulator I/O is best, while for others, memory I/O can simplify programming and speed the transfer of data to or from memory. Some microprocessors have no INput or OUTput instructions and support only memory I/O. Such chips frequently have special memory addressing instructions that can speed execution time for this type of I/O.

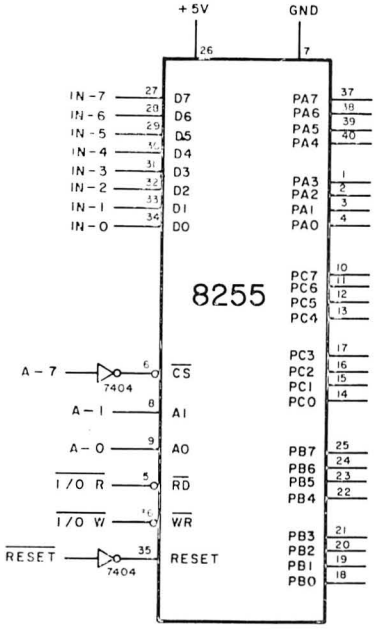

Figure 2
Accumulator I/O Interface Connection

The main advantage of programmable interface chips, such as the 8255, lies in the ease of connecting to an external digital device. No flip-flops, decoders or gates are required for the interface; they are all within the programmable chip. Usually, only 7404 inverters are needed to buffer levels to and from the chip pins. With the continued advent of LSI technology; watch for Moby Chip, the all-purpose CPU, memory and I/O, all on one chip!

SECOND SOURCE CORRECTION

We apologize to Zilog and Mostek for inaccurately printing information regarding who is second sourcing the Z-80 microprocessor in the July article, "The Zilog Z-80" by Donald Dobbs. You may have guessed, or already know, that it's Mostek. We hereafter promise to "second source" our information sources.

BIORHYTHMS IN PRACTICE

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By William L. Donham, M.D.

ARE YOU NORMAL?
HAVE YOU EVER HAD ONE OF THOSE DAYS?
IS IT 2001?

All of these are huckstering ads for the new fad of biorhythms and biorhythm analysis. These are books, calculators, formulas, programs for H.P. calculators, and finally, computer read-outs ranging in price from $25.00 for three color graphs down to $5.00 for high speed read-outs which include a lot of numbers and are very scientific looking.

For those of us in the hobby of computers, biorhythm is a natural. People will absentmindedly nod their heads when you tell them of your exciting hobby, but their eyes light up like a Las Vegas slot machine when they watch the computer print out their personal biorhythm analysis. They don't care how the machine works; it's telling them their future.

Various studies are supposed to have been done indicating a high degree of correlation between critical days and accidents. Many airlines are using these charts to attempt to reduce accidents. The National Safety Council has described the bio-rhythm theory in its magazines.

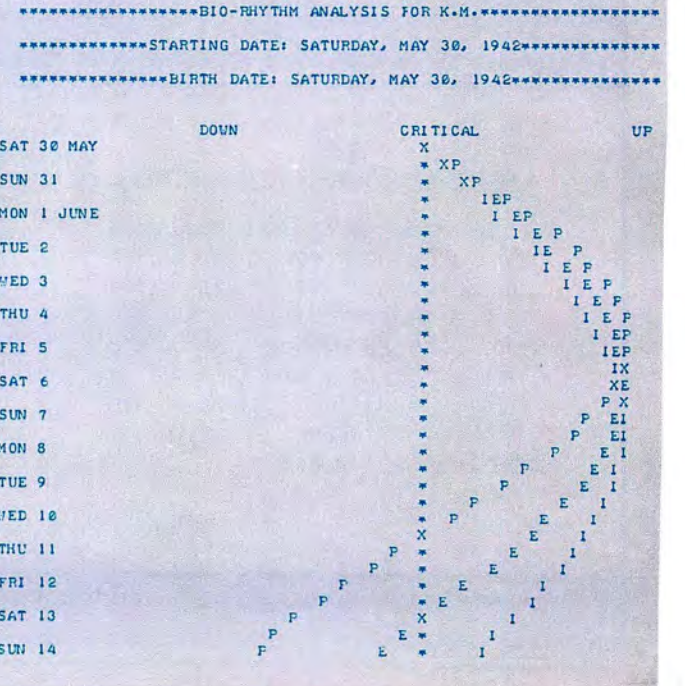
Biorhythm Background

The concept of biorhythm is supposed to have evolved through the works of a Vienna psychologist and a German physician early in this century. Working together, they collected evidence of a 23-day physical cycle, and a 28-day emotional cycle. The intellectual cycle, which is said to occur every 33 days, was developed later. The idea was brought to this country in 1922, and many biorhythm charts have been done since that time.

Predictable Cycles

The philosophy of biorhythm says you can know whether you're likely to be on the up side of the cycle or the down side. Biological rhythm is based on the theory that the energy of the brain and nervous system vary in cycles of fixed duration. These variations affect the physical, emotional and intellectual powers of each individual. The first half of each cycle is the "up" or positive phase, where that part of the system operates at maximum efficiency. The second half of the cycle is the "down" or negative period, when the system operates at a reduced level of efficiency. The real problem days are those when one or more of the cycles change from positive to negative, or from negative to positive. These are called critical days. They are full of potential problems because they are states of transition where you are more prone to errors, accidents and physical setbacks.

The three cycles start the day of birth and supposedly continue in the same fixed pattern throughout your life. The following is a computer read out of a typical start of the biological cycles.



"P" represents the physical cycle, "E" the emotional cycle and "I" the intellectual cycle, all starting at the critical line during birth.

I personally decided to run biorhythms on patients to see if I could find any correlation between their birth cycles and any accidents. My system consists of the IMSAI 8080 using 16K of memory, SWTP CRT for input, and an ASR33 teletype, both interfaced with the IMSAI 2S10 interface board. The program listing which follows is in 8K BASIC.

I ran the analysis after the accidents had taken place, feeling hindsight is a fairly absolute analysis. The following is what I have found so far. I do feel that a longer study is warranted. All patients were picked in order, as their accidents occurred, with the exception of Ken M. whose accident occurred several years ago. I have included a total of four charts which, without exception, correlate with the biorhythm theory. Admittedly this is a small sample but since it is so positive, I intend to run the curves on everyone with a true accident, and give the results to you in a future article.

Fig. 1 is L.H. While visiting her son, she stepped off the curb in front of his house and fractured her right leg—really a freak accident. The "E" curve goes through the critical line on the day she fractured the leg.

```
FIG (1)

*****************BIO-RHYTHM ANALYSIS FOR L.H.*****************
*************STARTING DATE: TUESDAY, JUNE 15, 1976*************
*************BIRTH DATE: SATURDAY, OCTOBER 9, 1928*************

                DOWN                CRITICAL                UP
TUE 15 JUNE                                              E  IP
WED 16                                                E  I  P
THU 17                                             E     I  P
FRI 18                                          E        IP
SAT 19                                       E     IP
SUN 20                                    E     P  I
MON 21                                 E     P  *  I
```

Fig. 2 Ken. Ken was skiing at Mammoth. On Wednesday, the 28th in 1973 he had an accident which resulted in a bad fracture of his right hip. He is still intermittently on crutches and will never recover the complete use of his right leg. The "I" or intellectual cycle crosses the critical line on the day of the accident. As an aside Ken's wife is very versed in astrology and warned him two days before the accident that there were many indications that he would have a good chance of an accident that particular day. Coincidence? It might be a good idea to subject some of that type of data to a computer.

```
FIG (2)

*****************BIO-RHYTHM ANALYSIS FOR KEN M.*****************
*************STARTING DATE: MONDAY, FEBRUARY 26, 1973*************
*************BIRTH DATE: WEDNESDAY, OCTOBER 3, 1928*************

                DOWN                CRITICAL                UP
MON 26 FEBRUARY                                  IP        E
TUE 27                                        I     P     E
WED 28                                     I           P  E
THU 1 MARCH                             I              P  E
FRI 2                                I                 E  P
```

Fig. 3 Ron A. Ron was in Northern California coming back home for the July 4th celebration. He was riding his Honda and admitted to me that his mind is a little blank about the circumstances of the accident. This may be a form of retrograde amnesia or his mental facilities may not have been what they should have been. The results were a fractured right clavical and multiple asphalt burns. The "I" or intellectual cycle goes through the critical line the day of the accident.

```
FIG (3)

*****************BIO-RHYTHM ANALYSIS FOR RON A.*****************
*************STARTING DATE: FRIDAY, JULY 2, 1976*************
*************BIRTH DATE: SATURDAY, AUGUST 7, 1954*************

                DOWN                CRITICAL                UP
FRI 2 JULY                                                  I
SAT 3                                                    I
SUN 4                                                 I
MON 5                                              P  I
TUE 6                                           I     X
```

Fig. 4 John A. John works in a produce market. The afternoon of the 7th he was loading boxes of fruit and walked into a knife he had put down under another box to hold it. Results were a deep knife wound in his left thigh. The "E" cycle goes through the critical line on the 8th. In this particular case the cycle indication occurs 12 hours after the accident.

```
FIG (4)

*****************BIO-RHYTHM ANALYSIS FOR JOHN A.*****************
*************STARTING DATE: TUESDAY, MAY 4, 1976*************
*************BIRTH DATE: SATURDAY, JANUARY 23, 1937*************

                DOWN                CRITICAL                UP
TUE 4 MAY                                                   E
WED 5                                                    E
THU 6                                                 E
FRI 7                                              E
SAT 8                                           E
SUN 9                                        E
MON 10                                    E     X
```

Well there you have it. Preliminary data which, at least in this small sample of four charts seems to indicate that there may be something to biorhythms after all. Admittedly, this is a very small sample but there are thousands of computer hobbyists. Try it on your friends and see for yourself. You will at least see how much people are interested in the basic idea. The program I have been using is not written by me and I wish to thank the unknown writer. I have made some modifications to the basic program to indicate the critical, up and down sides of the cycle.

```
1 DIMA(12),M$(12)
2 DATA0,31,59,90,120,151,181,212,243,273,304,334
3 FORI=1TO12:READA(I):NEXT
5 PI=3.14159
7 PRINT:PRINT
10 PRINT"THIS PROGRAM WILL PRINT OUT YOUR PERSONAL BIO-RHYTHM ANALYSIS"
20 PRINT"FOR A 30 DAY PERIOD STARTING AT ANY DATE YOU SELECT."
30 PRINT"DATES SHOULD BE ENTERED IN NUMERICAL FORM WITH THE MONTH,"
40 PRINT"DAY AND YEAR SEPARATED BY COMMAS..I.E..JULY 4,1976 WOULD"
50 PRINT"BE ENTERED AS 7,4,76."
55 PRINT"THE PROGRAM MAY BE EXTENDED TO ANY PERIOD OF TIME BY"
60 PRINT"CHANGING THE STATEMENT IN LINE 475 TO THE NUMBER OF DAYS"
65 PRINT"DESIRED."
70 PRINT:PRINT
80 PRINT"WHAT IS THE DATE AT WHICH YOU WOULD LIKE THE 30 DAY ANALYSIS"
90 PRINT"TO START?"
100 INPUTM,D,Y
105 M=INT(M):D=INT(D):Y=INT(Y)
110 INPUT"WHAT IS THE DATE OF YOUR BIRTH";MB,DB,YB
115 MB=INT(MB):DB=INT(DB):YB=INT(YB)
117 INPUT"WHAT IS YOUR NAME";A$
120 PRINT
130 DEFFNI(X)=INT(20*SIN(2*PI*X/33)+.5)
140 DEF FNE(X)=INT(20*SIN(2*PI*X/28)+.5)
150 DEF FNP(X)=INT(20*SIN(2*PI*X/23)+.5)
160 T=INT(D+365.25*Y+A(M)+.01*M-.03)
170 TB=INT(DB+365.25*YB+A(MB)+.01*MB-.03)
180 X=T-TB
183 V=INT((40-LEN(A$))/2)
184 RB=TB-1-INT((TB-1)/7)*7
210 DATA MONDAY,TUESDAY,WEDNESDAY,THURSDAY,FRIDAY,SATURDAY,SUNDAY
230 FORI=0TO6:READDAY$(I):NEXT
240 DATA MON,TUE,WED,THU,FRI,SAT,SUN
250 FORI=0TO6:READD$(I):NEXT
260 DATA JANUARY,FEBRUARY,MARCH,APRIL,MAY,JUNE,JULY,AUGUST
268 PRINT:PRINT
270 DATA SEPTEMBER,OCTOBER,NOVEMBER,DECEMBER
272 FORI=1TO12:READM$(I):NEXT
273 PRINTSPC(2):FORI=1TOV:PRINT"*";:NEXT
274 PRINT"BIO-RHYTHM ANALYSIS FOR "A$;
276 PRINT"*";:IFPOS(0)<66THEN276
278 PRINT:PRINT
280 R=T-1-INT((T-1)/7)*7
282 LE=21+LEN(DAY$(R))+LEN(M$(M))+LEN(STR$(D))+LEN(RIGHT$(STR$(Y),2))
283 V2=INT((64-LE)/2)
285 PRINTSPC(2):FORI=1TOV2:PRINT"*";:NEXT
290 PRINT"STARTING DATE: "DAY$(R)", "M$(M)STR$(D)", 19";
292 PRINTRIGHT$(STR$(Y),2);
295 PRINT"*";:IFPOS(0)<66THEN295
297 PRINT:PRINT
300 LL=LEN(DAY$(RB))+LEN(M$(MB))+LEN(STR$(DB))+LEN(RIGHT$(STR$(YB),2))
301 LB=LL+18
302 VB=INT((64-LB)/2)
303 PRINTSPC(2):FORI=1TOVB:PRINT"*";:NEXT
304 PRINT"BIRTH DATE: "DAY$(RB)", "M$(MB)STR$(DB)", 19";
305 PRINTRIGHT$(STR$(YB),2);
306 PRINT"*";:IFPOS(0)<66THEN306
307 PRINT:PRINT:PRINT
```

```
308 PRINT TAB(20)"DOWN",TAB(40)"CRITICAL",TAB(63)"UP"
310 PRINTD$(R)D;M$(M);
320 F(0)=42:F$(0)="*"
330 F(1)=42+FNI(X):F$(1)="I"
340 F(2)=42+FNE(X):F$(2)="E"
350 F(3)=42+FNP(X):F$(3)="P"
360 FORI=0TO2
370 FORJ=I+1TO3
380 IFF(I)<F(J)THEN420
385 IFF(I)=F(J)THENF(I)=0:F$(I)="":F$(J)="X":GOTO420
390 Q=F(I):Q$=F$(I)
400 F(I)=F(J):F$(I)=F$(J)
410 F(J)=Q:F$(J)=Q$
420 NEXTJ:NEXTI
440 FORI=0TO3
450 PRINTTAB(F(I));F$(I);
460 NEXT
470 PRINT:X=X+.5:IFINT(X)<>XTHEN320
475 IFZ=29 THEN 570
480 R=R+1:IFR=7THENR=0
490 D=D+1:IFM=4ORM=6ORM=9ORM=11THENL=30:GOTO530
500 IFM=2ANDY/4=INT(Y/4)THENL=29:GOTO530
510 IFM=2THENL=28:GOTO530
520 L=31
530 IFD>LTHEND=D-L:M=M+1:GOTO550
540 PRINTD$(R);D;:Z=Z+1:GOTO320
550 IFM=13THENM=1:Z=Z+1:GOTO310
560 Z=Z+1:GOTO310
570 PRINT:PRINT
580 END
```

Computer Construction Hints

By M. Mallon

Having built electronic kits of one sort or another for the last thirty years, I wasn't too concerned about construction problems when introduced to computers recently. How different from hi-fi and oscilloscopes could it be? I reasoned; after all, resistors are resistors, no matter whether Bach or Bytes are surging through them. I was soon to learn about the differences, and this article is intended to pass along the solutions I used to handle them.

As some one else mentioned recently, if you are expecting a Heath-Kit "hold-your-hand" approach when working on either IMSAI, Processor Tech, Polymorphic, or Tarbell, you are in for a rude awakening. Lacking a big budget for tech writers and artists, none of these companies as yet does an adequate job of helping you through the kit build-up stage on their products.

Most of them seem to take the "—now solder in all of the resistors—" approach, glossing over details of construction that can make the difference between weeks of trouble shooting or "no fault" operation. They seem to feel that including a one-page disclaimer about not using "corrosive solder," plus some sketches of what an integrated circuit looks like, absolves them of any further responsibility. Until such time as they improve their manuals, you are on your own. Perhaps these building hints will help get you through the worst of it.

Rule #1: Always use sockets for *all* the integrated circuits. Yes, I know that they are rarely supplied and that they are an additional expense, which is why they *are* rarely supplied. Never mind that, just get yourself a handful and use them. Everywhere. If you pay more than 25¢ for a 16 pin platform, you're shopping at the wrong places.

One brand is as good as the next. Just be sure the socket has an anti-wicking shield (thin plastic) on the bottom side. Augat, incidentally, makes an excellent free-standing (individual) contact that lets you socket those odd-size 10 pin, 18 pin and 8 pin devices. One experience shuffling I.C.'s around during checkout and you'll bless the day you invested in sockets.

Rule #2: Stick to a 25 Watt soldering iron and use a heat sink clip. Even though sockets have spared your I.C.'s from the heat, there are those poor diodes and transistors to think of. A simple heat clip and a low wattage iron are your best guarantee against return visits to Radio Shack for fresh IN 914's. I move up to a 45 watt element when doing buss connections and other heavy duty tasks, but the little 25 watter handles 95% of all soldering jobs on these kits. Two more suggestions before we leave the subject of soldering: use a good magnifying glass *immediately* after each joint. Subsequent component installation may obscure your view of shorts, cold solder, etc. It takes longer, but it's worth it. Also, keep a "Solder-Sucker" handy for inevitable repair jobs. Tugging at a lead is doing it the hard way, as well as an invitation to lifted circuitry. A six buck solder removal tool pays for itself the first time you discover a transistor you put in backwards. Considering the poor quality of component layout drawings supplied, I would expect the error rate on installation to be 2% or better.

Rule #3: Check all parts very carefully. I had two kit-makers supply a wrong I.C. In one case, he had made a circuit change, but erroneously included the old parts list and schematic. The other example was stranger. I.C. manufacturers are required to put a data code on all devices. The way it works is that 7408 stands for the eighth week of 1974, the time of manufacture. Coincidentally, the kit, called for a 7408 device and what I got instead was a 7400 (small letters) made during (you guessed it) the eighth week of 1974. Don't laugh, it will happen to you. I promise. Take nothing for granted. Check each label and color code carefully before inserting on your board. It can save an unbelievable amount of grief during checkout.

Rule #4: Use heat sink grease on all regulators. They never tell you about this one, but I consider it an important safeguard for cooler operation of those much-overworked three terminal regulators. Be sure to get some between the heat sink and the board, as well as on the device itself. Some kit manufacturers think nothing of pushing these devices well above normal limits. Grease helps by conducting more heat to the sink and onto the board. Heat can be the biggest problem your machine will have, and for that reason I also suggest you

1. Install a fan (both MITS and IMSAI provide a location).
2. Mount all resistors up off the board at least 1/8" (heat is your problem, not vibration).
3. Plug your cards in every *other* slot if you can spare the space.

So much for the Golden Rules of good construction. Here's a half-dozen more hints intended to save you from unnecessary aggravation. You have enough to worry about just getting a trouble-free machine to do its number—no sense building in problems.

1. Before starting construction, plug

the board into your machine. Surprise! I had one that needed 1/8" lopped off each side to fit my 10" wide IMSAI card cage. It's easier to shear a bare board than a loaded one.

2. Another worthwhile precaution is to Xerox both faces of your bare board. These snapshots can be helpful after construction during checkout. You may not need them, but considering the poor quality of most schematics supplied, you'll welcome all the road maps you can get if trouble occurs.
3. Fire up those LEDs on a test rig before soldering in place on your board. Nothing is more frustrating than searching for a lost signal only to discover that you had installed a bad LED. Some kit manufacturers stint on the LEDs, and I've had 4 out of a group of 45 as rejects. Some light dimly and are best discarded.
4. Make yourself a "shorting board" when working on your connector backplane (referred to as "mother board"). Here's how it works: Install the first 100 pin connector carefully, making sure you have no solder bridges between that very narrow line work. Make your "shorting board" out of a piece of printed circuit material (1/16" thick—copper-clad, both sides). Cut it to span from pin *2* to pin *49* and plug it in. A buzzer or ohmmeter hooked up during the rest of your connector installation will identify any shorts the instant they occur. It beats hunting through 2200 solder joints to find out why half your memory is inoperative.
5. Use a good flux solvent (trichlorethylene is one) to clean your boards. This does more than just make them sparkle. Solder rosin doesn't conduct very well, but contaminated rosin can act like a high resistance bridge. In the strange world of 2 MHz pulses, you're well advised to practice good housekeeping and scrub your boards.
6. Check out all on-board voltages before plugging in any I.C.'s. Make sure the regulator and any zeners you've installed are doing their job before sacrificing your expensive 91L02s, or whatever else you have.
7. One area that all the kit manufacturers *do* warn you about has to do with static electricity. Pay attention! MOS devices are especially vulnerable to damage in this manner. Keep yourself grounded when plugging these (or any other I.C.'s) into your board. Blow an 8080 or your UART chip and you're out 25 bucks or more. The manufacturers may nullify your warranty if they identify a static zap as the reason you mailed that dead bug back to them.

Some day, perhaps in the not too distant future, kit documentation will improve. Schematics will have *all* pin designations listed. Test points will be featured and waveforms illustrated, much the same as any Sam's Photofact sheet offers now for TV servicemen. Total current consumption will be recorded as a quick check for identifying whether that hot-running MC 7805 is *supposed* to be handling 1100 MA or there's trouble on board.

I'm convinced that all these goodies and more are in store in the future, but until then, these hints, and your common sense, are your best safeguard against trouble. ◻

NO VOWELS AT ALL

There are only five vowels in the English language—less than 20% of all the letters. But we would be in trouble without them, as this short program written in BASIC illustrates.

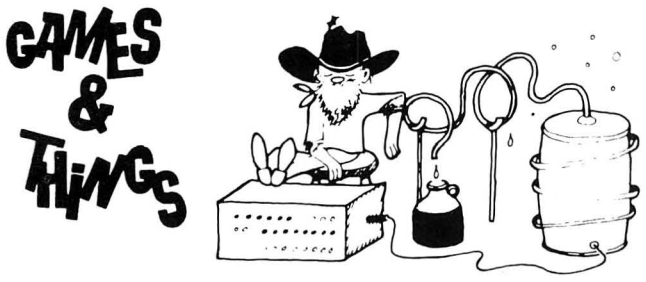
One person enters a word, the machine spells the word without vowels, and the object is for others to determine the word.

Children ages 7 to 12 find the game enjoyable.

LIST

```
 10 INPUT A$
 15 PRINT:PRINT:PRINT:PRINT:
    PRINT:PRINT:PRINT:PRINT:
    PRINT:PRINT
 20 FOR N=1 TO LEN (A$)
 30 B$-MID$(A$,N,1)
 40 IF B$="A" GOTO 100
 50 IF B$="E" GOTO 100
 60 IF B$="I" GOTO 100
 70 IF B$="O" GOTO 100
 80 IF B$="U" GOTO 100
 90 PRINT B$;
100 NEXT N
105 PRINT
110 GOTO 10
199 END
```

◻



by Tom Rugg and Phil Feldman

If you've been playing around with MITS Basic, you know that it stores numbers internally with six significant digits. In fact, the Basic manual says that if you print a number larger than 999999, it will be displayed in scientific notation.

Obviously, you can't print an integer if it's greater than or equal to one million, right?

Wrong.

And, obviously, if you want to find out exactly what some large number is, like 23 to the 24th power, or 42 factorial, you're out of luck, right?

Wrong again.

This month we'll show you a simple program written in 8K Basic that can do these things.

"POWERS OF N" PROGRAM

The program shown in Figure 1 generates either successive powers of an integer you provide or factorials. The output can have as many as 60 digits, and with simple modifications, it could handle much larger numbers. We stopped at 60 digits so the output would fit on one line of a teletype.

As you can see from the sample output in Figure 2, the program first asks you for the length of the largest number you want to generate ("Number Of Digits"). After you provide a number (integer) from 1 to 60, it asks you to "Enter N."

If you enter an "N" of 1, the program generates factorials. For those of you who have forgotten such things, three factorial is 3 times 2 times 1, or 6; four factorial is 4 times 3 times 2 times 1, or 24, and so on.

If you provide an N in the range of 2 through 9999, the program instead generates the powers of that number. For example, entering a 5 will get you 5 to the first power, then 5 squared, then 5 cubed, and so on.

In either case (factorials or powers), the program will keep generating numbers until it has generated the largest number that will fit within the number of digits you have asked for. Then it will come back and ask you for another set of "Number Of Digits" and "N."

HOW IS IT DONE?

The method for accomplishing this "multiple-precision arithmetic" is really pretty simple.

The array X is set up to have one element for each digit in the number you're going to create. The number N (that is going to be the multiplier) is placed in the zero-th element of X. Then a loop is entered (lines 230 to 280) to "reduce" the number in the X array, so that a digit from 0 to 9 is in each element. This is done by "carrying" over into the adjacent digit. For example, if we were doing powers of 47, the carrying would leave the "7" in X(0) and the "4" in X(1).

Then the digits in the X array are printed, after placing one digit at a time in the X$ string. (The loop from 290 to 360 scans backwards through the X array to find the first non-zero digit, which becomes the first character in the X$ string.)

The loop from 390 to 410 then multiplies each digit in the X array by N, and then we go back to reduce and print again.

That's all there is to it. Now you can impress your friends with the incredible number-handling power of your computer. Try a casual conversation starter like, "Say, Fred, what do you suppose 763 to the fourteenth power is?"

OTHER POSSIBILITIES

What this program really does is multiply a multiple-precision integer (in the X array) by a single-precision integer (N) to get a multiple-precision product (in the X array).

A more interesting (and complicated) program would be one that had at least six subroutines so you could add, subtract, multiply, divide, print, and interchange a *pair* of multiple-precision integers. Except for division, all six would be pretty easy to program.

With these six subroutines, you would be able to do all sorts of fascinating things with little more than a series of GOSUB statements. Anybody feel up to taking this on?

The Powers of N program, by the way, has plenty of room left when run with 8K Basic on an 8K machine. With some minor modifications, it could be made to run in 4K Basic, and would probably fit on a 4K machine. You would have to remove all the string manipulation statements and put a PRINT loop in the program where line 370 is. You would probably also have to limit the maximum number of digits to about 20 or 30. The output might not be as pretty, but it would still work.

Thanks go to Art Armstrong and Rick Edelman for the use of their computers so we could test this program.

Figure 1
PROGRAM LISTING OF "POWERS OF N"

```
100 CLEAR 150
105 PRINT
110 INPUT"NUMBER OF DIGITS";L
112 IF L>60 THEN 110
113 IF L<1 THEN 110
114 IF L<>INT(L) THEN 110
115 DIM X(L)
130 U=1:E=U:Z=0:J=Z:F=Z:T=10
135 X$=""
140 INPUT"ENTER N";N
150 IF N<Z THEN 140
160 IF N>9999 THEN 140
170 IF N=Z THEN STOP
180 IF N=U THEN F=U
190 IF INT(N)<>N THEN 140
200 IF F=Z THEN PRINT"POWERS OF";N
210 IF F=U THEN PRINT"FACTORIALS"
220 X(J)=N
```

```
230 J=Z
240 IF X(J)<T THEN 270
250 Q=X(J)/T: Q=INT(Q): R=X(J)-Q*T
260 X(J)=R: X(J+U)=X(J+U)+Q
270 J=J+U
280 IF J<L THEN 240
290 J=L
300 IF X(J)=Z THEN J=J-U: GOTO 300
310 IF J=L THEN 430
320 PRINT E; TAB(6);
330 W=J
335 V=0
340 Y$=STR$(X(W)): X$=X$+RIGHT$(Y$, U)
345 V=V+U
350 W=W-U
360 IF W>=Z THEN 340
370 PRINT X$
375 X$=""
380 IF F=U THEN N=N+U
390 W=Z: E=E+U
400 X(W)=X(W)*N: W=W+U
410 IF W<=J THEN 400
420 GOTO 230
430 FOR W=U TO L: X(W)=Z: NEXT W
440 GOTO 100
OK
```

Figure 2
SAMPLE RUN OF "POWERS OF N"

```
NUMBER OF DIGITS? 20ENTER N? 1
FACTORIALS
 1     1
 2     2
 3     6
 4     24
 5     120
 6     720
 7     5040
 8     40320
 9     362880
 10    3628800
 11    39916800
 12    479001600
 13    6227020800
 14    87178291200
 15    1307674368000
 16    20922789888000
 17    355687428096000
 18    6402373705728000
 19    121645100408832000
 20    2432902008176640000
 21    51090942171709440000

NUMBER OF DIGITS? 25
ENTER N? 101
POWERS OF 101
 1     101
 2     10201
 3     1030301
 4     104060401
```

BRANCH to . . . pg. 66

UP 'N RUNNIN'

by Stephen Tuenge

The main function of a front panel on an ALTAIR-like 8080 system is to allow the user to access the memory for initial programming. Besides the memory access functions, the CPU may be started, stopped, reset, and single-stepped through a program by use of the front panel switches. Data flow from the CPU to the user is handled by a series of LEDs to display the current address, data out of the CPU, and CPU status. Moving the complexity of the front panel controls for memory access functions from the front panel wiring to a single chip results in a simple, easy to build unit that can have as many features of the original as desired.

The design presented here uses a 5204Q from Godbout Electronics with their MICRO-MONITOR program preprogrammed into it ($29.95). There is a catch, though. Using this software for memory access means that the computer will not stand alone. Proper functioning is predicated on having a complete system. The imposed requirements, though, are not inordinate, and all that's needed is a standard ASCII input/output device. Inasmuch as the same device (or devices if a TV Typewriter and keyboard are to be used) is needed for any serious use of the computer anyway, nothing has been lost.

Because the ALTAIR was designed with memory write functions as part of the front panel, an essential circuit is not complete on the CPU. In order to write into memory at all, the circuit of Fig. 1a is needed. The 2.2K resistor shown as Fig. 1b is just for insurance as SS should float high on the CPU board.

The remaining circuitry involved can be broken into three separate sections:

1. The PROM and its enabling circuitry.
2. A means for the user to start the monitor program at will.
3. Optional functions (RUN, STOP, SINGLE STEP and data display).

The 5204, and the circuits directly associated with it, is shown in Fig. 2. IC B, a 74LS30, NANDS the high order address bits along with SMEMR so that when the CPU expects an input from either of the last two pages of memory (376.000 through 377.377 octal) the $\overline{CS}$ line (Chip Select- active low) goes low, and enables the 5204 where the low order address bits are decoded internally. The schematic shows pin 2 connected to ground. However, if this pin (the power saver input) is connected through a switch, the user has the option of disabling the PROM and allowing RAM to occupy the last two pages of memory by bringing the power saver input high (through a 2.2K resistor to +5v). The 5204 is considerably slower than the 8080, so IC D imposes two wait states whenever the 5204 is accessed. Inasmuch as the monitor programs operating speed is constrained by the input/output used by the system, the wait states do not show up as an operating limitation.

Fig. 3 shows an easy method of getting the monitor program running. In order to get the CPU working in the monitor program, a jump command to the first address of the PROM is generated (303 000 376 octal). To prevent conflict with the first three bytes of RAM, the hard wired jump command is located outside normal memory space, and enabled only when needed. The jump command is read over the CPU 'sense' lines (indicated on Fig 3 by the dashed line showing the cabled output to the CPU board) while the data input buffers on the CPU board are disabled, eliminating the possibility of conflict on the data buss lines. In operation, the *delayed* system reset signal, PRESET, initiates the action by setting the RS flip flop (½ of IC F). Since it can take over 7 microseconds for the CPU to reset, the setting of the flip flop is delayed until it is safe to disable the data input buffers without fear of having the CPU write a bunch of garbage into memory. The set condition

FIGURE 1a

FIGURE 1b

of the flip flop, A_0, A_1, and PDBIN are decoded by the 74155 to give one of three lines low, in order, when the CPU expects the first three bytes of input after a system reset. A couple of simple gates and a few open collector inverters convert the sequential information from the 74155 to the actual jump. Since all the address and status lines go high while the 8080 is resetting, it takes more than just using the $\overline{CS}$ signal to return the flip flop to normal operation. By combining the $\overline{CS}$ signal with one of the *low* address lines to derive the resetting signal, the system will return to normal as soon as the 5204 is accessed with the 8080 running the monitor program.

It will be noted that the circuits described exceed the ALTAIR standard of one LOW POWER TTL load per board on all the buss lines. With a small system, it's all right to cheat a bit (the prototype is running in a system with 16K of RAM, three input and two output ports and shows no sign of any ill effects). If a larger system is to be used, the buss lines should be buffered, and the outputs should be through buss drivers.

With wire wrap, the layout is entirely up to the builder. If all the IC's are set off to one side of the prototyping board, there is room enough for two input and two output ports on the same board. Since the layout effects the choice of which gates to use in the simpler TTL packages, pin designations are given only for the IC's in which there is no choice.

The Godbout monitor PROM comes with directions for use and a complete listing of the program. Following the directions given, the user can load data or programs into any portion of memory at will and read the contents of memory (displayed in octal, of course), or even punch or read a paper tape (if interfaced to a teletype), all just by typing in commands on the keyboard. If the system reset line, $\overline{PRESET}$, is run out to the keyboard, the only switch left on the front panel is the on/off. As an added bonus, by using a PROM for all the memory access functions, the user has access to all the subroutines used in the program and a simple call to the appropriate subroutine in the PROM can replace many routines (for example, to output the contents of the A register as an ASCII character, a call to OUTA

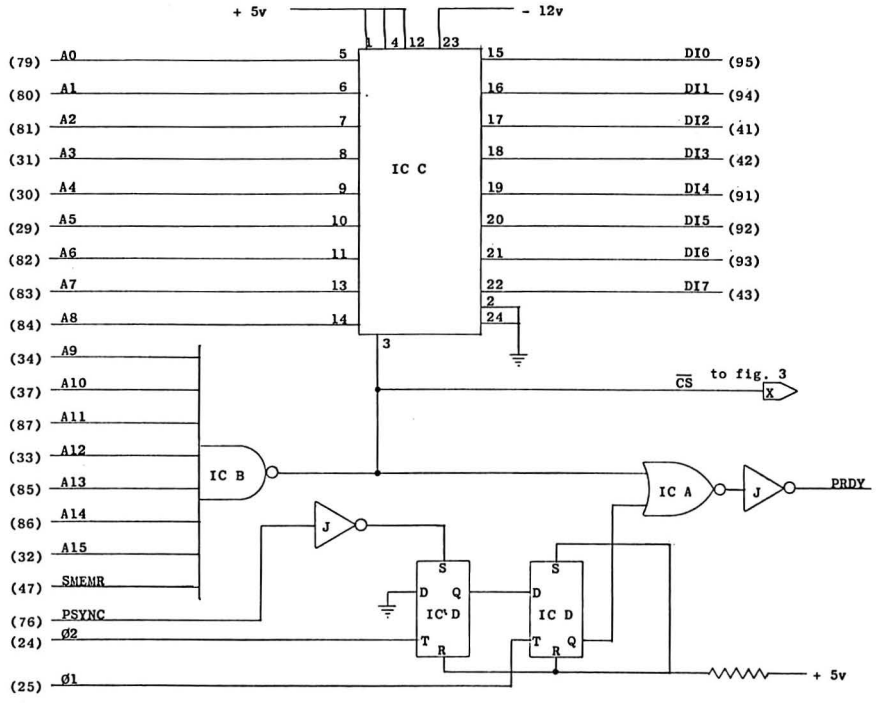


FIGURE 2

does the whole thing). A careful examination of the supplied listings will reveal many useful routines.

The optional portion of the front panel in this configuration, since it is a vital part of the hard wired DMA (Direct Memory Access) version of the front panel, will be presented next month with the DMA front panel. In any case, the circuits described here are all that's needed to get a system up and running. For those who wish to add RUN, STOP and single-step to their machines, next month's circuits can be added on at any time. ■

IC LIST

IC	TYPE
A	74LS02
B	74LS30
C	5204Q (from Bill Godbout Electronics, with micro-monitor)
D	74L74
E	NE555
F	74LS00
G	74155
H	7405
I	7405
J	74LS04

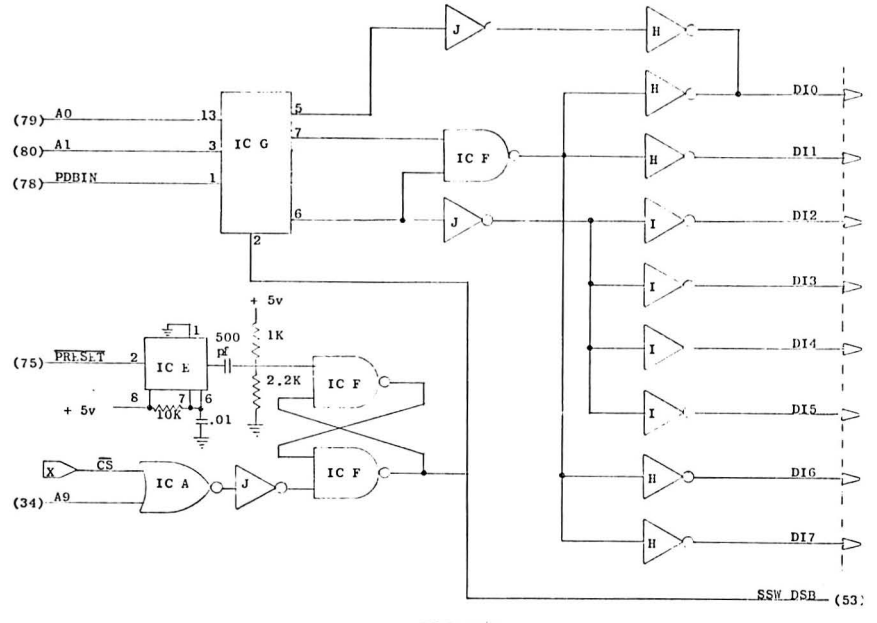


FIGURE 3

Bits & Bytes

by Mike Teener

I put the ALTAIR 680 together a few weeks ago. It turned out to be remarkably easy—easier than my Heathkit oscilloscope. The instructions were clear and all the parts were present. This is not to say things were perfect. There were two errors. The first mistake, admittedly minor, was that the holes for the switches in the front panel were slightly too small (due to thick paint), and had to be drilled out. The second was more serious, and quite frustrating. There were two transistors used in the power-on reset circuit which were backwards on the circuit board silk-screen. The result was that the reset line was constantly being pulled low, keeping the 6800 MPU chip in a state of suspended animation. As far as I could see, everything was working okay, except the MPU. The clock worked, the voltages were all okay . . . I thought the MPU chip itself was bad.

So down I went to the Computer Store where there was an actual working model. It was there that I discovered the little MITS foul-up. After a quick fix and some other repairs after the 6800 had been rather rudely dropped to the floor, we connected it to a teletype and (CR) (LF) (PERIOD) . . . It worked! It worked! I ran a quick little test program to test memory — which checked out—and then just sat there looking at it.

So what now? Nothing, I'm afraid. The memory board from MITS costs too much for either me or my MasterCharge right now. Shortly, though, it will be all fixed up . . . running my income taxes, figuring the rent/food/utility bills for my house, and frustrating everyone who tries to play MY version of Star Trek.

NEW STUFF FROM THE TRENCHES

A 64K-bit RAM memory chip from the Japanese. That's right . . . 64 big ones. You can't even get a ROM with that much capacity, yet, and you probably won't be able to get it for a long time. Production won't start until next year, and then all the

BRANCH to . . . pg. 62

Book Review

DATA COMMUNICATIONS DICTIONARY
By Charles J. Sippl
Van Nostrand Reinhold
Price: $19.95

"Microcomputer—Complete small computing system, consisting of hardware and software, that usually sells for less than $500 and whose main processing blocks are made of semiconductor integrated circuits. In function and structure, it is similar to a minicomputer, with the main difference being price, size, speed of execution, and computing power. The hardware of a microcomputer consists of the microprocessing unit (MPU), which is usually assembled on a PC board, memory, auxiliary circuits, power supplies, control console, and cabinet."

That is a direct quote from Charles Sippl's latest book. This dictionary is so complete, for example, that he describes 36 separate definitions for terms beginning with "input/output. . ." Included are definitions of terminology relevant to new developments in data communications applications, the latest equipment, capabilities, and software.

Categories of information include: Microcomputers, multi-mini computer systems, developments in microwave, satellite, "packet" and laser communication, CATV networks, programmable calculators as terminal systems, and input/output voice communications systems.

A separate section in the back of the book is devoted entirely to acronyms and abbreviations, and looks to be extremely thorough.

Just released this April, we feel this book provides the best accumulation of easy-to-read reference material available to date, for the hobbyist and professional involved with computers and related communications fields.

COMPUTERS MADE REALLY SIMPLE
By Kent Porter
Thomas Y. Crowell Company
Price: $8.95
Reviewed by Sheila Clarke

This book is an excellent introduction to all aspects of computing for the person who is just getting started, either as hobbyist or professional. Written in "English", the author avoids computer jargon and gives the reader real-life situations to relate to when explaining how a computer thinks, how to talk to the computer, and what the computer does with the information fed to it. When introducing the concept of computer functions, Mr. Porter takes the fear out of it by analogizing computer components with human anatomy. This is a simple way to comprehend what computers are all about.

Without going into much detail about individual computer languages, the book gives an opportunity to understand some of the basic logic underlying language and it's construction. Some detail is devoted to binary numbering, coding and decimal system and exercises are presented here to test our new knowledge. The reader is then superficially introduced to higher language philosophy using EBCDIC code.

CPU components are discussed as the "brains" of the computer, and here is where the reader gets the basics everyone should have when embarking on computer interaction. Control unit, arithmetic logic, memory modules and I/O devices are all simply explained. In the chapter, "Directing An Idiot", Mr. Porter gives the reader a primary lesson in programming, complete with logic, human problem analogy, and coding. These pages are filled with flow-charts for easier comprehension.

The appendices include reviews, exercises and a brief glossary of the terms the author covers.

The text is written in such simple terms, that we "grownups" might have a tendancy to become impatient, believing that the book is more suitable for a 10th grade student. But for someone totally un-

familiar with computers, taking care to read *everything* will pay off. And as you read on, you can get so caught up in your new understanding that the simplicity will no longer be aggravating.

Although the book seems to be focused on large scale systems and business applications, the principles are the same for all computers. As the author states in the text, "The purpose of this book is to familiarize you with computers in general . . ."

Porter closes with remarks which seem apt for the hobbyist. "One thing is certain. The computer is here to stay. Every day and in every way, its tiny pulses of massive power are becoming more of an indispensable organ of humanity . . . As the importance of the computer grows, which it is certain to do, more and more people will be compelled to familiarize themselves with this magical idiot.

"It falls to all of us to make certain that this powerful tool we have created for our convenience continues to be used for our good."

BOOKS IN BRIEF

MICROCOMPUTERS/MICROPROCESSORS: HARDWARE, SOFTWARE AND APPLICATIONS By John L. Hilbrun and Paul M. Julich, published by Prentice-Hall, Inc.

This book is a practical coverage of ten microprocessors from Intel, RCA, Rockwell, Motorola and National, written to help the reader fully utilize the chips power and flexibility in solving engineering problems. Emphasis is on the latest large scale IC technology, with methods for almost any minicomputer application. It provides a number of programs in machine and assembly language for using programmable interfaces, IC interfacing elements and I/O peripheral devices. Just released, 285 pages with illustrations ($16.50).

ENCYCLOPEDIA OF COMPUTER SCIENCE Edited by Anthony Ralson and Chester L. Meek, published by Petrocelli/Charter.

Just out in July, its publishers claim this to be the first and only one-volume complete coverage of the *entire* field of computer science. It's loaded with illustrations, tables and charts, and includes articles covering theory, legal aspects, educational applications, hardware and software. Its appendix provides all terms that would appear in any computer dictionary, abbreviations, math notations and numerical tables. The price is steep, but perhaps well worth its 1,523 pages at $60.

TAB BOOKS 1976 CATALOG.

Dozens of specialized electronics books are listed, falling under headings such as "Math, Calculators & Computers", "Test Equipment", and "Electronic Music" to name a scant few. Rather than discuss the several excellent books which are listed, we're recommending you send for the catalog and see for yourself. Write to P.O. Box 40, Blue Ridge Summit, PA 17214.

DIGITAL TROUBLESHOOTING: Practical DigitalTheory and Troubleshooting Tips by Richard E. Gasperini, published by Hayden Book Co., Inc.

This book was written as a training program for Hewlett-Packard, and is now available to all who are interested in finding out how to make their computer kits *work.* Included are discussions of test instruments that replace or extend the oscilloscope in troubleshooting. Examples of material covered can be exemplified by listing some of the book's chapter titles: Digital vs. Analog; MOS; Logic Symbols; Number Systems; Counters and Shift Registers; Display Technology; Memories; Boolean Equations; and many more, price: $9.95.

IMSAI 8080 vectored from . . . pg. 44

it appeared necessary to add a number of ICs to the interface between the keyboard and the computer to achieve compatibility with my friends' Altair. That was added to the fact that we had to install another key on the keyboard to be used as a control key. With all these matters before me, I decided to keep the keyboard for future modifications, and get another for my present use.

I am still in the process of getting my system into operation, but my remaining difficulties have revolved around input/output devices. Ultimately, I will install a full computer-based power typing system in my office with original keyboard access to a CRT, and either disk or cassette storage.

SOFTWARE

IMSAI's advertisement stated that they would ship an assembler, loader and monitor with every unit, *together with BASIC and other languages.* This assembler appeared to be a rewrite of one originally distributed by Processor Technology Corp. It uses all of the 4K memory, and needs additional 2K of RAM, if not more. A complete source program of this assembler, together with an 8-level punched paper tape, were enclosed with the basic IMSAI unit. IMSAI also provided a listing and a punched paper tape containing the software required for use with their cassette recorder interface board. On about March 20th, IMSAI wrote all customers stating they were now ready to deliver the 4K BASIC, and expected to deliver the 8K and 12K BASICS on April 15th and May 15th respectively. The 4K has arrived . . . and I've since been advised by IMSAI that the 8K BASIC was sent back for rewrite and would not be ready for shipment until mid-July.

IMSAI's price for 4K BASIC and its source code listing totals $14.00. They additionally will sell the 8K and 12K for $1.00 per kiloByte of memory required to contain the language in paper tape form; the source code listing for these two extended BASICS will again be $2.50 per kiloByte, or $20.00 for the 8K and $30 for the 12K extended text. This is probably a great bargain despite the possibility that IMSAI's may not be quite as powerful as MITS 4K.

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Tentative plans include technical presentations, commercial displays, individual exhibits (either actual or documented) and hobbyist competition in the areas of hardware, software, games, and applications. The games competition is planned to take place on large scale systems which will be made available specifically for the contest in true Texas fashion. Mr. Tom Gentry has accepted the responsibility for communicating with the various hobbyist organizations and interested individuals to compile suggestions and data regarding the personal computing portion of the convention. All interested parties are urged to write him at Icom, East Inc., 3331 Towerwood, Dallas TX 75234.

Ms. Isaacson stated, "Being both an enthusiastic computer hobbyist and conference chairman for the 1977 National Computer Conference, I have an unusual opportunity—I can provide a forum and an exposition that will bring the world's attention to the tremendous

BRANCH to . . . pg. 62

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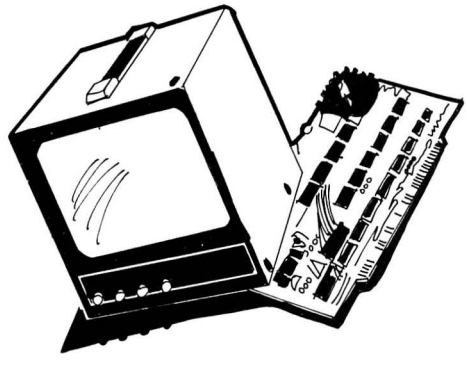

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CIRCLE NO. 31 ON INQUIRY CARD

UPDATE vectored from . . . pg. 60

personal computing movement. At the same time, since it is sponsored by the American Federation for Information Processing Societies, and is hence not associated with any profit-making organization, the NCC is an ideal national meeting place for the many individuals, organizations and corporations involved in low cost computing."

CALENDAR

August 4, Wednesday—San Fernando Valley Chapter Meeting. 7:15 pm at the Harvard School, 3700 Coldwater Canyon Rd., North Hollywood. Contact John Scott (213) 849-4094.

August 5, Thursday—Group Purchase order deadline. For more information, write to Chris Marshall, 3238 Faust, Long Beach, CA 90808. Taped message of offerings at (213) 425-5120.

August 8, Sunday afternoon—North Orange County Computer Club (NOCCC) meeting. Write for location at P.O. Box 3603, Orange, CA 92665, or call (714) 998-5831.

August 10, Tuesday—Santa Monica Bay Chapter Meeting at Venice Pavillion at Windward in Venice. Contact Larry Press at (213) 399-2083 for more information.

August 11, Wednesday—SCCS Board of Directors meets at the Veterans Administration in West Los Angeles at 7:30.

August 20, Friday—SCCS Singles Chapter Meeting 7:30 p.m. at Imperial Savings in Studio City. Call Jerry Silver at (213) 877-7056 or 789-5873.

August 20, Friday—AGCNJ Meeting, Mercer County College, Trenton, NJ. For more information write 1776 Raritan Rd., Scotch Plaines, NJ 07076.

August 24, Tuesday—Teachers Chapter meets at 2:30, Granada Hills High School Computer Lab. Call 645-2304 or 368-1711 for more information.

August 28, Saturday—SCCS General Meeting.

August 28 and 29—Personal Computing '76, Atlantic City, NJ, sponsored by the Southern Counties Amateur Radio Assn. of New Jersey. Write them c/o Shelburne Hotel, Boardwalk & Michigan Ave., Atlantic City, NJ 08404 (609) 927-6950. To arrange travel, contact Travel Coordinators, 8317 W. 3rd St., Los Angeles, CA 90048. Group tour arrangements available. Call (213) 655-0650, collect calls accepted.

August 28, Saturday—Ventura County Computer Society meets at the Camarillo Library, 3100 Ponderosa Dr. For more information, write P.O. Box 525, Port Hueneme, CA 93041.

August 31, Tuesday—San Gabriel Valley Chapter meeting, 7:30 p.m., at Pasadena Central Library Auditorium, 385 E. Walnut St., at Garfield Ave. For more information write P.O. Box 9459, North Hollywood, CA 91609.

BYTES vectored from . . . pg. 58

big computer manufacturers are going to want it.

Remember a few months back when I jokingly referred to a 370/Tiny? Well, a minicomputer manufacturer, Interdata, just announced a microprocessor implementation of their 7/16, which is remarkably similar to an IBM 360. If they would just change the microcode design a little.

And that's not all. Next year Hewlett-Packard is bringing out a microprocessor version of their 21MX mini. It will be *faster* than the original. There will also be a three-chip implementation of their 3000 series computers, which aren't minis, but true medium-scale computers with a business orientation.

So now I have a prediction—flourish of trumpets, please: Within five years, you will be able to get an IBM-360 emulator with two selector channels, a multiplexer channel (IBM jargon for I/O) and about a megabyte of memory for about $30K. Of course, it will be as powerful as an old 360/50, which costs about half a megabuck. Actually, I think I'm being conservative.

That's all for now. I want to check out the new SWTP printer and the rash of new cassette interfaces. I may actually be able to afford them.

INTERFACIAL vectored from . . . pg. 2

few of them each month. This and other publications are chock full of tutorials, kit building projects, and warnings about what and what not to do. Good grief! The letters we get asking for advice amaze me, when the answers can be found by flipping through the very pages of the magazine from which the asker got our address. Research isn't easy, but no one can give ready-made solutions. And what we don't read or can't find can be learned by asking other members of SCCS, computer store dealers, or members of local computing groups.

So what I've seen is manufacturers who imply that "anyone" can put their kits together, and hobbyists who expect that to be exactly the case. What I'd like to see is more open dialogue between both; the hobbyist may have to have more tolerance and patience than he's accustomed to as a paying customer, and manufacturers must be more receptive to criticism and more honest about delays and mistakes. Obviously, mistakes have been made and efforts toward correction must be made on both sides.

The battle might be easier to take all the way around if we stop to realize that we're all deeply involved in a new field which embraces technology and human interaction. We're developing new "muscles," and exercise makes these muscles sore. The result, however, should give microcomputing the promise of continuing growth for everyone.

Actually, I think we have a great game going for potential winners on both sides.

IN THIS ISSUE

Nine microcomputers are reviewed and compared by hardware-oriented Ralph Wells. For the first time, we have an opportunity to see almost every microcomputer now on the market lined up in Ralph's "Report Card." He gives us a general summary of the virtues and faults he has experienced with each. Why did Ralph Wells buy *nine*? Well . . . when he ordered the first kit a year and a half ago, and it didn't arrive as expected, he ordered a second from another manufacturer, and when that one didn't arrive as expected . . . well, you get the picture.

Cliff Sparks completes his invaluable series on teleprinter maintenance. We've had requests for reprints and back issues from readers who want to obtain the full series. Cliff, however, has no plans to reprint, and we are unfortunately out of the February and March issues. So, if you want the entire series, check your nearest computer or electronics store . . . maybe *they* didn't sell out.

Teletype information is augmented this month by Tom Gallant's "TTY Single-Character Reader Control." His has been working for months now, and he willingly shares the information with us.

If you've been entertaining thoughts about implementing your color TV set for color graphics, take a look at Sheila Clarke's report on what is currently available, what you'd best watch out for, and what a real-live up and running system looks like.

Our tutorial this month introduces

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CHARACTER SET
Standard: 64 ASCII characters, displayed as upper case, plus punctuation and control.

CHARACTER GENERATION
5 × 7 dot matrix.

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75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19,200 baud (switch selectable).

COMPUTER INTERFACES
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New data enters on bottom line of screen; line feed causes upward scrolling of entire display with top-of-page overflow. Automatic new line switch selectable, end-of-line audible tone.

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CIRCLE NO. 32 ON INQUIRY CARD

EXCHANGE vectored from . . . pg. 6

```
BIOSIN - A BIORHYTHM CHART PLOTTING PROGRAM

WRITTEN FOR ALTAIR 8K BASIC (VER. 3.0)
WITH 12K OF MEMORY REQUIRED.

THE PROGRAM IS SELF EXPLANATORY WHEN EXECUTED.

GOOD LUCK!

PAUL GREENE
3547 FAIRCHILD ST.
LA CRESCENTA, CA.
91214
(213) 248-8039
```

```
5 DIM A(12),B$(12),C$(63),Z$(30)
33 PRINT"FOR WHOM IS THIS CHART?";:INPUT Z$
106 FOR I=1TO7:READA$(I):NEXTI
107 FOR I=1TO12:READA(I):NEXTI
108 FOR I=1TO12:READB$(I):NEXTI
113 DEF FNY(Y)=29-SGN(Y/4-INT(Y/4))
115 DEF FNS(S)=INT(20*SIN((S/P-INT(S/P))*6.28318)+40.5)
117 DEF FNM(X)=INT(7*(X/7-INT(X/7))+.5)
119 DEF FNK(K)=INT(100.1*(K/100-INT(K/100)))
159 PRINT "BIRTHDAY (MM,DD,YYYY)";:INPUTM,D,Y
163 Y=FNK(Y):IFM=1THEN174
165 A(2)=FNY(Y):FORI=1TOM-1:D=D+A(I):NEXTI
174 PRINT"STARTING DATE? (MM,DD,YYYY)";:INPUTM1,D1,Y1:D0=D1
177 Y1=FNK(Y1):A(2)=FNY(Y1):IFM1=1THEN189
181 FORI=1TOM1-1:D1=D1+A(I):NEXTI
189 S=0:FOR I=Y+1TOY1-1:IF I/4=INT(I/4) THEN S=S+1:NEXT I
193 IF Y/4=INT(Y/4) THEN S=S+1:IF D>59 THEN 197
195 S=S+((Y1-Y-1)*365):S=S+(365-D):S=S+D1
196 GOTO 202
197 IF Y/4=INT(Y/4) THEN S=S-1:GOTO 195
202 D3=Y1*365+D1-3
203 FOR I=1TOY1-1:IF I/4=INT(I/4)THEN D3=D3+1:NEXT I
206 PRINT"DAYS PLOTTED?";:INPUTD9
209 D1=D0:GOSUB300
211 PRINT:FORI=1TO72:PRINT"+";:NEXTI
213 PRINT:PRINTTAB(30);"(-)      (0)      (+)"
214 FORQ=1TOD9:E=FNM(D3-1)+1:PRINTA$(E);:PRINTD1;:IFZ<1THEN224
223 IF D1<> 1 THEN 226
224 PRINTB$(M1);:PRINTY1;:Z=Z+1
226 IFA$(E)="SUN"THEN229
227 FOR I=LEN(C$)+1TO63:C$(I)=" ":NEXTI
228 GOTO 230
229 FORI=1TO63:C$(I)="-":NEXTI
230 FORI=1TO3:P=18+(5*I):X(I)=FNS(S):NEXTI
236 C$(40)="I"
238 C$(X(1))="P":C$(X(2))="S":C$(X(3))="C"
240 IF X(1)=X(2)THENC$(X(1))="X"
242 IF X(1)=X(3)THENC$(X(1))="X"
244 IF X(2)=X(3)THENC$(X(2))="X"
251 PRINTTAB(14);:FORX=15TO63:PRINTC$(X);:NEXTX
255 PRINT:D3=D3+1:S=S+1:D1=D1+1:IFD1<A(M1)+1THEN267
261 D1=1:M1=M1+1:IFM1<13THEN267
264 M1=1:Y1=Y1+1:A(2)=FNY(Y)
267 NEXTQ
268 PRINT:GOSUB290
272 FORI=1TO10:PRINT:NEXTI
277 DATA"MON","TUE","WED","THU","FRI","SAT","SUN"
278 DATA31,28,31,30,31,30,31,31,30,31,30,31
279 DATA"JAN","FEB","MAR","APR","MAY","JUN"
280 DATA "JUL","AUG","SEP","OCT","NOV","DEC"
281 END
290 PRINT:FORI=1TO72:PRINT"#";:NEXTI
291 RETURN
300 FORI=1TO10:PRINT:NEXTI
302 GOSUB 290
304 PRINT"B I O R H Y T H M   C H A R T ":PRINT
310 PRINT"FOR":PRINT:PRINTZ$:Z=0:PRINT:PRINT
322 PRINTTAB(10);
326 PRINT"YOU HAVE LIVED "S" DAYS AT THE START OF THIS PLOT.":PRINT
328 PRINTTAB(10)"'P' STANDS FOR PHYSICAL CYCLE.";
329 PRINTTAB(57)"(23 DAY)"
330 PRINTTAB(10)"'S' STANDS FOR SENSITIVITY CYCLE.";
331 PRINTTAB(57)"(28 DAY)"
332 PRINTTAB(10)"'C' STANDS FOR COGNITIVE ";
334 PRINT"(INTELLECTUAL) CYCLE.";:PRINTTAB(57)"(33 DAY)"
342 PRINT:PRINT:PRINT"CRITICAL DAYS:";:PRINT:PRINT
344 PRINT"     WHENEVER A CYCLE CROSSES THE MEDIAN LINE, THIS IS"
346 PRINT"A 'CRIT;CAL DAY'.  YOU ARE SUPPOSED";
348 PRINT" TO BE MORE PRONE TO"
349 PRINT"ACCIDENTS ON THAT DAY, SO BE CAREFUL!!"
352 PRINT:PRINT:RETURN
OK
```

REAL TIME MUSIC

Cheth Rowe in Seattle is a professional programmer/analyst, but his interest in computers at home is prompted by his avocation as a musician. Cheth's application is real time music which he coordinates with fellow musicians. He's building a homebrew 6800 system using a radio for his main peripheral, fully relocatable assembler, and hopefully video and cassette I/Os in the near future.

Perhaps he'll share his program with us which gen-

BRANCH to . . . pg. 66

WHAT IS VTL/1?

Very Tiny Language/1 is a high level language, similar to BASIC, designed to run on your 1K Altair[T.M.] 680 Computer.

How much of my 1K does it use up?

NONE! The whole language fits into those three empty read only memory sockets already on your CPU board.

Gosh, that's only 768 bytes. How did you make it so small?

It was written in elvish by pixies in the Black Forest.

Suppose I had a problem using it, would I have to fly to the Black Forest to get an answer?

Not at all. **The Computer Store** has spared no expense in bringing the cheif pixie right here to Santa Monica.

You mean I can talk to the man who wrote it?

Sure! Just call **The Computer Store** and ask for Gary Shannon.

How much will all this cost me? Plenty I'll bet.

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- Books and Magazines

EXCHANGE vectored from . . . pg. 64

erated his latest song, "Digital Interface", and we'll be able to print the listing in a future issue. For now, here's the libretto.

DIGITAL INTERFACE
Copyright by Cheth Rowe 1976

Digital Interface
Lovely
Crystal Time Base

Wrap it all up
What do you get?

Micro
Processing
Reflecting
Your head.

Digital Interface
Lovely
Crystal Time Base

Feed in the Blues
MOS CPU's
MOS CPU's
MOSS . . . ◘

CONTROL vectored from . . . pg. 27

that last burn rate was a real dog! So we punched a tape for all input, except the last entry, and let the computer do all the work up to that point. We figured that since people are smarter than computers, why should we waste our valuable time doing the same thing over and over? Well, after another hour or so, we finally got the "perfect landing" message. Maybe that hour shows how smart we are. ◘

GAMES vectored from . . . pg. 55

```
5     10510100501
6     1061520150601
7     107213535210701
8     10828567056280801
9     1093685272684360901
10    110462212541120451001
11    111566834666531655551101
12    11268250301319697206612O1

NUMBER OF DIGITS?

OK     ◘
```

MAINTENANCE vectored from . . . pg. 22

number 1 is the female plug, that plug firmly attached to the CCU. Since that plug is a *plug,* let's call it P1, or BD. The male connector that jacks into P1 or BD shall be known as J1. You will find no (or very little) information on J1 because we just don't use the darned thing, but the identification system must be understood by the reader. If all the Teletype schematics were made available to you, I'm sure you'd discover that BC (P2), when mated with J2 which had terminals 7 and 8 connected to your 8080 data "in" circuit, would put you in business. You would further discover that terminals 4 and 6 on the "X" block would produce the same results. The point is that many of the terminals on the "X" block appear on the Molex plugs.

If you attempt any hook-up to or from the CCU, be sure that the following conditions are met.

1. P1 Jack not necessary.
2. P2 Line input.
3. P3 Inputs on J3 from printer functions. You must have a jumper from terminal 7 to 8.
4. P4 J4, selector magnet inputs on terminals 11 and 12. AC printer motor inputs on terminals 1 and 3.
5. P5 J5 used only if you have an automatic tape reader.
6. P6 J6 Tape reader jack.
7. P7 J7 Keyboard input jack.
8. P8 J8 Answerback jack.

Take a close look at Figure 4 and you should be able to piece the Keyboard, Answerback and tape reader connections together.

This concludes this series on the Model 33ASR/KSR, although I had thoughts of trying to provide the reader with symptoms and probable causes for the troubles found in the printers. I've just about given up that idea due to the many variables that jump into the picture. It's hard for me to explain that the sound the printer makes during its operation is a key to the trouble source, or that garbling may be nothing more than a loose nut atop the print drum. The most common trouble found with any printer is often a nut loose at the keyboard. ◘

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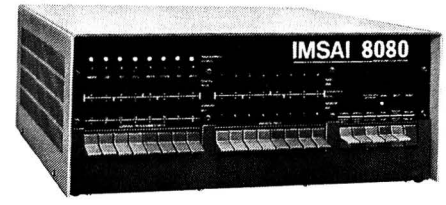
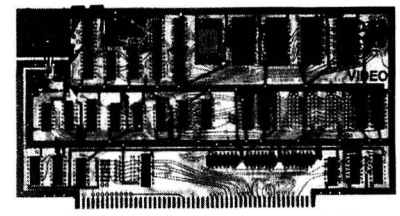


MICROCOMPUTER

POLYMORPHICS



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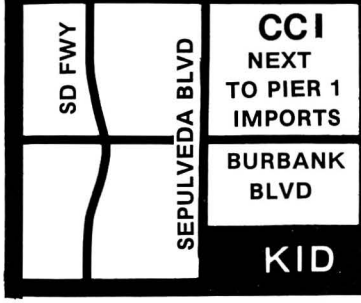

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CIRCLE NO. 36 ON INQUIRY CARD

SOFTWARE FETCH

by Art Childs

Two years ago computer hobbyists were an unheard of breed. One year ago the few of us who had been bitten by the digital bug were still busy putting our hardware together. And now, with ready-to-program micros growing in number and kind monthly, we find our attention turning increasingly to software, the subject of this column.

Technically, software includes much more than programs and languages. When we encounter an unusually good technical publication, we'll pass our discoveries along, but for the most part, this column will be devoted to keeping you appraised of available languages and programs, as well as passing along a few programming tips.

IN THE BEGINNING THERE WAS BASIC

Among-non-professionals, BASIC is probably the most widely used of all higher level languages. It is undoubtedly for this reason that we can find several "home-brew" versions called TINY BASIC written for microcomputers in the pages of *Dr. Dobb's Journal.* For those of us willing to spend a few hours at the keyboard inputing the code, or for those who care to learn a bit about writing an interpreter, *Dr. Dobb's Journal* has much to offer. Don't expect the kind of power in TINY BASIC that you enjoy on your local time-share system—it isn't there. But its price is right: the cost of a subscription to an interesting publication.

The most widely used BASIC among hobbyists at the moment is Altair BASIC, which comes in several versions 4K, 8K and Extended. (Rumor has it that a ROM version is soon to be released). The Extended which requires 10.5K just for the object code, is the most popular (although since the release of Lynn Cochran's Star Trek, the arc-tan function may never be initialized again). Unlike TINY BASIC, the price isn't quite so right—at least it wasn't intended to be, but it will suit most hobbyists' needs well. It has begun to find its way into many of the standard software packages for commercially available systems, and has been written for the 6800 as well as the 8080. The major drawback to the versions this writer has seen is the I/O. Console communications are limited to TTY through Altair I/O boards and cassette. More sophisticated I/O requires modification to the software. Still, it's a good language for the home computer enthusiast and well worth the time necessary to make it play on your micro.

SOPHISTICATED BASIC

We hobbyists have known for quite some time that microprocessors and home computing are about the hottest item to blow into town since the hoola hoop. And now the big kids are finding out. Besides the fact that hobbyists are being taken seriously by such organizations as Zilog, makers of the Z-80, and by Project Support Engineering, makers of the Pacer, we have been discovered by Ryan-McFarland, a software house with many achievements to its credit including more than 70 compiler systems. RM recently announced a BASIC with a plus-MICRO BASIC I, written for the 8080. They will soon announce a version for the 6800.

The "plus" is the fact that MICRO BASIC I is more than a basic interpreter. It's a system which includes a compiler as well as flexible I/O, fast integer arithmetic, and really powerful string features. We could find only two drawbacks for the hobbyists—the price (although it should be well worth $335 to $500 for a business venture) and the lack of floating point arithmetic. However, we have been informed that tentative plans have been made to add floating point in the future. We hope so, as it is an otherwise fine piece of software for hobbyist or professional. For more information contact Hamilton/Avnet.

INEXPENSIVE SOFTWARE DEVELOPMENT SYSTEM

The professionals aren't the only ones who have been busy—and this time, I'm happy to report, *the price is right.* Michael Shrayer has put together a software development system which consists of an assembler, an editor and a monitor in one package on cassette, and is making it available at a price that is well within the hobbyist budget: $30! The assembler, although lacking macro capability, is almost as good as any this writer has seen for the 8080. The editor is of the line-oriented variety, and the monitor will do just about everything but single step and the dinner dishes. Further, Shrayer is offering a service many will want; i.e., for $15 and your original cassette, he will reassemble the entire package to run in any 8K block of memory. (The original version resides from 6000H to 7FFFH). The end statement, (meaning "bottom-line" in computerese), is simply this—for $45 the hobbyist can obtain a good set of development software by writing Michael Shrayer at #331, 930 S. Bonnie Brae St., Los Angeles, CA 90005.

THE PACER

When I decided to do the software column I resolved to stick to software, leaving hardware to those TTL guys with the crazy CRT that talks in lines instead of ASCII, but I've got to make at least one exception. It's about the PACER, manufactured by Project Support Engineering. The particular version I'm referring to is the one using National Semiconductor's PACE, a 16-bit chip. We will have a product evaluation article coming up soon, so I won't go into detail, but I do want to pass this along: if number-crunching is your game, the PACER may well be the machine for you—and until September 30, 1976 the first five members from each computer club can obtain one at a $294 discount—that is $699 instead of the usual $993 price.

The PACER is one of the few ready-to-use machines on the market and the kit assembles in two or three hours. All the PC boards are pre-assembled and tested. It contains an abbreviated keyboard which allows use of monitor/debugger, including 10 break points, and a hex display. Options include a TTY RS232 interface with a ROM based line assembler, a PROM programmer, a prototyping board, and extended memory board. Options planned for the future include cassette interface, disk operating system, CRT interface and 8080 CPU board.

Many may find the PACER a bit on the expensive side, but for the person who is more interested in data processing than games or control applications, it's a good machine.

8080 MEMORY SAVER

Subroutine calls are very useful instructions when properly used. In the 8080, calls are especially useful in that the call can be conditional; i.e., CZ; call if zero bit set; CNZ, call if zero bit not set; CC, call if carry bit set; etc. When a call is executed, the contents of the program counter (the address of the first instruction following the call instruction) are pushed onto the stack. This allows returning to the calling routine by terminating the subroutine with a RET (return) instruction. When the return is executed, the top of the stack is popped off into the program counter causing execution to be continued at the instruction following the call.

Many pieces of software require the eventual return to a starting point. For example, the command routine in a monitor or operating system. In such a case a simple RET will not do because we do not always know where the departure from the main line will occur, so we simply terminate with a JMP.

```
MAIN LINE

START:    CALL INPUT ; GET COMMAND
          CPI 41H ; COMMAND = A ?
          JZ RTNA ; YES
          CPI 42H ; COMMAND = B ?
          JZ RTNB ; YES
          CPI 43H ; COMMAND = C ?
          (etc.)
RTNA:     JMP STRAT
RTNB:     JMP START
RTNC:     JMP START
```

Fig1

As we can see from Figure 1, calls to the various subroutines could not be used, thus each subroutine had to be terminated with a JMP START, each of which cost the programmer three bytes. If the subroutine were many, say 26 in number, the total cost of the jump instructions would be 78 bytes, enough for an additional routine or two. If the code is intended to reside in a 1702, those 78 bytes represent a significant portion of the total available. Here is a simple technique for saving 48 of those 78 bytes:

```
START:    LXI H, START
          PUSH H
          CALL INPUT
          CPI 41 H
          JZ RTNA
          CPI 42 H
          JZ RTNB
          CPI 43 H
          (etc.)
RTNA:     RET
RTNB:     RET
          (etc.)
```

Fig. 2

In Figure 2 a call is simulated by pushing the address of "START" on the stack so that when the various subroutines are terminated with a RET, a program execution will continue to start. This same method may be used when any other point in the program is desired as a continuation point.

```
START:    LXI H START
          PUSH H
          LXI H, GO
          PUSH H
          CALL INPUT
          CPI 41
          JZ RTN $
(etc.)
To continue execution at START:
RTNA:     POP H (or any other register pair)
          RET
To continue execution at GO:
RTNB:     RET
```

Fig. 3

One word of caution—keep track of your stack between the original jump instruction and the terminating return—that is, for each push or call, make sure there is a corresponding POP or RET, otherwise you may find yourself attempting to execute the second instruction after Wednesday in left field.

With the entry of the iCOM Floppy in the hobbyist market, disk operating systems have become a subject for discussion, so in a future issue we will talk about some of the features of FDOS and how to use them. Until then, hang on to your marbles, your bits and your RAID. You just might need them. ■

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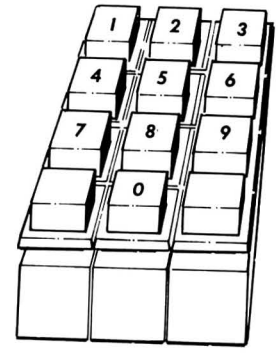

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CIRCLE NO. 37 ON INQUIRY CARD

LARGE SCALE SYSTEMS VOCABULARY

by Ralph Klestadt

Before one can really understand some of the aspects of large scale systems, one should know some of the basic terms. The following is a list of terms and definitions that one will need to know when discussing a large scale system. This is only a basic list, and by no means covers all of the terms of large scale systems.

SOFTWARE

ALGOL 10 — ALGOrithmic Language (DEC)—A FORTRAN-like programming language which offers scientific advantages of FORTRAN and advanced algorithmic processing capabilities. Used on timesharing systems mainly.

ALGOL 68 — ALGOrithmic Language (IBM)—Much like ALGOL 10, this version of the language offers Input/Output facilities more prone for the batch environment. Used mainly on batch systems, although it is also used on some select timesharing systems.

APL — A Programming Language (IBM)—A very efficient and quick programming language used only on timesharing systems. APL uses non-standard programming symbols, and consequently, it is very difficult to read.

BASIC — Beginner's All-purpose Symbolic Instruction Code (Dartmouth University)—One of the most widely used programming languages, meant for beginners as well as advanced programmers. BASIC is a highly understandable programming language and one who programs in BASIC needs little prior knowledge in computers. Used mainly on timesharing systems, and real time systems. Also commonly used on minicomputers.

COBOL — COmmon Business Oriented Language (IBM) —The most widely used programming language in the business world. It is made up mainly of English-like statements and was designed so that people with little or no computer experience could program in it with great ease. Used on batch, real time, and timesharing systems.

DDT — Dynamic Debugging Technique (DEC)—A system program that enables the programmer to debug, or fix up, his program very quickly without having to re-run it each time. DDT works at the machine, or assembler level. Used exclusively on timesharing systems.

DOS — Disk Operating System (IBM)—A rather old operating system that utilizes disks for operating system work and is generally slower than other operating systems. Used exclusively on batch systems.

FORTRAN 4 — FORmula TRANslator (IBM)—A scientific/mathematical programming language which is one of the oldest languages currently in wide use. It considers each line to be a mathematical statement or an Input/Output statement, resulting in a powerful language to use. Used on batch systems most often.

FORTRAN 10 — FORMULA TRANslator (DEC)—The equivalent of FORTRAN 4 in many ways, yet it offers much more advanced Input/Output facilities which are more user-oriented. Used exclusively on timesharing systems.

HASP — Houston Automatic Spooling Processor—A type of operating system mostly used on the System/360 and /370 series. It is totally batch oriented and is an alternative to OS.

ICS — Integrated Command System (Compu-Serv Network)—A very powerful version of TOPS-10 which has nice features such as monitor-level editing and user communication. Used only on timesharing systems.

ITS — (CDC)—A type of operating system used mostly on Control Data timesharing systems. Used only on timesharing systems.

JCL — Job Control Language (IBM)—A system which interprets instructions that are given to it by the user and then processes them in order to tell the central processor what to do with the user's program. Used on batch and timesharing systems.

LISP — LISt Processing language (Stanford University)—A programming language used in artificial intelligence. It is a very high level language and is very complicated, being quite complex to program in. Used on timesharing, batch, and real time systems.

LOADER — A program required on all systems that loads the user's program along with required system routines into the central processor for execution. Used on timesharing, real time, and batch systems.

MAD — Michigan Algorithm Decoder (*Michigan University*)—A highly specialized programming language developed quite early. Used on batch systems.

MPB — Multi Program Batch (DEC)—An operating system equivalent to JCL that is used to convert a timesharing system environment to a batch environment. MPB is more user-oriented than JCL is, featuring debugging statements. Used on timesharing systems.

Operating System—A main program which has control

of everything being done, hardware and software, on the system. All programs run under the operating system or in the control of the operating system. Used on all systems.

OS — Operating System (IBM)—A type of operating system that is used exclusively on System/360 and /370 configurations. OS is totally batch oriented and only slightly user-oriented. Used on batch machines only.

PL/1 — Programming Language 1 (IBM)—A type of programming language developed in the late 1960's, meant to be a cross between FORTRAN 4 and COBOL. Used on batch systems mainly.

SNOBOL 4 — StriNg-Oriented symBOlic Language (Bell Telephone Labs)—A programming language developed in the early 1960's used mainly for advanced string manipulation. Some examples of this would be in artificial intelligence, compiler construction, and text preparation. Used on batch, real time, and timesharing systems.

SOS — Son Of Stopgap (DEC)—An editing program, used on systems for quick and fast alteration of user programs. Used on timesharing systems only.

TECO — Text Editor and COrrector (DEC)—An editing program more advanced than SOS because of its capability to execute multiple commands and paging operations combined on one line. It offers a more advanced command set than SOS, along with offering basic arithmetic computation capabilities. Used on timesharing systems only.

TENEX —A type of operating system somewhat like TOPS-10 but offering facilities for network communication between individual computers. Used on timesharing systems only.

TOPS-10 — (DEC)—A type of operating system used on the DECsystem-10, offering a user-oriented environment. TOPS-10 is the basis of other monitors, and is one of the most widely used. Used on time sharing systems only.

TSO — Time Sharing Option (IBM)—A type of operating system that emulates quite well a timesharing system on a batch system. TSO does not, however, offer all the features that a true timesharing monitor does. Used on batch systems.

UTILITIES—A group of programs that perform duties such as program checkout, editing, word processing, text preparation, and accounting that are standard software or installation implemented. Used on all systems.

VS — Virtual System—A type of operating system under which the user utilizes the system in a method that appears to be accessing more storage for him than the system actually has. A virtual system emulates this extra storage. Used on batch and timesharing systems.

HARDWARE

1403 — (IBM)—A very common type of line printer device for outputting data from the central processor.

3150 — (CDC)—A popular type of business computer.

3330 — (IBM)—A popular type of magnetic disk mass storage device.

6600 — (CDC)—A popular type of general purpose timesharing computer.

ARPANET—a nationwide computer network encompassing all of the major universities and government installations. The ARPANET consists practically entirely of large scale systems.

ASCII — American Standard Code for Information Exchange—A system of electronic coding of characters and symbols used on some large scale systems.

BATCH—A type of computer where the program input is accomplished through cards and one program is executed after another.

CENTURY — (NCR)—A type of general purpose large scale computer system.

CDR—CarD Reader.

CRT — Cathode Ray Tube—A type of terminal device used for connecting up to a large scale system that resembles a television screen.

CTY — Console TeletYpe (DEC)—The terminal that the computer operator uses at the central site of the computer.

DECsystem —10 (1040,1050,1055,1060,1070,1077, 1080, 1090)(DEC)—A popular type of large scale timesharing system that can also perform batch, timesharing, and real time concurrently.

DECNET — (DEC)—A type of communications net work able to interface the DECsystem-10 line with minicomputers.

DECTAPE — (DEC)—A type of magnetic tape storage device that is about five inches across and offers the high-density storage of conventional magnetic tape along with the fast access and portability of cassette tapes.

DISK—A type of magnetic platter that is rotating at high speed and can store massive amounts of data.

DISK PACK—A package of multiple (up to 10) disks stacked one on top of another and held in place by one main column.

EBCDIC of BCD — Binary Coded Decimal (IBM)—A system of electronic coding of characters and symbols used on IBM large scale systems only.

LPT—Line PrinTer.

MF10 — (DEC)—A type of add-on memory that can be attached to a large scale system to increase its capability.

PTP—Paper Tape Punch.

PTR—Paper Tape Reader.

REAL TIME PROCESSING—A system where users communicate with the system as in a timesharing system, yet the processor executes one job at a time, like batch.

RJE — Remote Job Entry (IBM)—A system where the user may enter his program to a batch computer and yet not be at the central site.

RPO4 —(DEC)—A type of disk system like the 3330

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THE INTERFACE AGE

by Jean E. Jones

It was the winter of the year when the S.S. Interface was launched. In December she hoisted sail when the wind was fair, flying the flag of S.C.C.S.

She carried all the vitals tools and cargo for the Computer Hobbyist. Hers was a craft of communication, with standards, ideals and principles.

She was a proud lady. For it is skill, not strength that governs a ship, and the press extends itself according to the character of those who direct it.

The Interface was built with perseverance, a larger comprehension of the truth in technological advances, and the sharing of information in the personal computing field.

As the Interface gained speed in productivity and demand, each month her beacon shined brighter as the S.C.C.S flag whipped to the winds of Time.

On high seas the navigation was as rough as the restless waves, but she gloried as the Star Ship did with her blinking lights, for her bridge was now glowing with usefulness and service for thousands of Computer Hobbyists. No ghost ship was she!

Collisions were averted, for then her energy could be destroyed. The Interface kept up her shields; the sextent must be true, for if you collide with a star, your galaxy will forfeit you.

Each monthly journey of the Interface proved more valuable. With each docking came a reverberating carillon of grateful message from individual hobbyists, from governmental, educational and industrial systems and organizations.

It was in the velocity of the cross-winds that she held a major briefing, . . . Then the Interface altered her course. There was new charting in the control room. From within the forces a new order and age evolved. Now a new flag ripples and streaks to the breeze, stronger, and equipped with responsibility and self-reliance . . .

We say farewell to our former flag. With a glowing memory of S.C.C.S. we now carry a new flag for individuals, small businesses and industrial hobbyists venturing into the computer spectrum, *and those who* have already been on tour.

We salute you. We welcome you aboard. Our gauges and dials are on target. We have secured the hatches and bid the new Interface Age FULL SPEED AHEAD!

BLACK JACK

BLACK JACK

BLACK JACK

by Richard Edelman

With money and social stature, you can play it at Monte Carlo. With just money, you can play it in Las Vegas. At home, all you need is a computer, Basic and Richard Edelman's Black Jack (and use the money you win, or save, to buy another 4K memory). Good luck.

```
1000 DM C(52),V$(10)
1010 INPUT "INSTRUCTIONS ";I$
1030 IF LEFT$(I$,1)="Y" THEN 3310
1040 C=0
1050 FOR K=0 TO 3
1060 FOR J=1 TO 10
1070 C(J+10*K)=J
1080 NEXTJ:NEXT K
1100 FOR J=41 TO 52:C(J)=10:NEXT J
1130 V$(1)=" A"
1140 V$(2)=" 2"
1150 V$(3)=" 3"
1160 V$(4)=" 4"
1170 V$(5)=" 5"
1180 V$(6)=" 6"
1190 V$(7)=" 7"
1200 V$(8)=" 8"
1210 V$(9)=" 9"
1220 V$(10)="10"
1230 L=40
1250 IF L<40 THEN 1340
1260 FOR J=1 TO 52
1270 Z=C(J)
1280 R=INT(RND(J)*52+1)
1290 C(J)=C(R)
1300 C(R)=Z
1310 NEXT J
1320 L=1
1330 PRINT "NEW DECK":PRINT
1340 T=0
1350 T1=0
1360 S=0
1370 S1=0
1380 INPUT"BET = ";B
1400 IF B=0 THEN 1260
1410 IF B>500 THEN 1380
1420 IF B<1 THEN 1380
1425 IF B<> INT(B) THEN 1380
1430 GOSUB 2940
1440 GOSUB 3090
1450 PRINT "     ";V$(C(L-1))
1460 GOSUB 2940
1470 GOSUB 3090
1480 H=C(L-1)
1490 IF C(L-3)=1 THEN 2820
1500 IF T=21 THEN 2690
1510 IF T1=21 THEN 2770
1520 INPUT D$
1530 IF LEFT$(D$,1)="G" THEN 2400
1540 IF LEFT$(D$,1)="D" THEN 2370
1550 IF LEFT$(D$,1)="H" THEN 2270
1560 IF LEFT$(D$,1)="S" THEN 1590
1570 PRINT"     RETYPE: ";
1580 GOTO 1520
1590 IF C(L-2)<>C(L-4) THEN 1570
1600 PRINT"FIRST HAND"
1610 B1=B
1620 PRINT V$(C(L-2))
1630 X=C(L-2)
1640 T1=X
1650 GOSUB 2940
1660 IF X<>1 THEN 1690
1670 T1=T1+10
1680 GOTO 1900

1690 INPUT D1$
1700 IF LEFT$(D1$,1)="G" THEN 1900
1710 IF LEFT$(D1$,1)="D" THEN 1870
1720 IF LEFT$(D1$,1)="H" THEN 1750
1730 PRINT"     RETYPE: ";:GOTO 1690
1750 GOSUB 2940
1760 IF T1>0 THEN 1820
1770 X1=0
1780 C=C-B1
1790 B1=0
1800 PRINT"BUST"
1810 GOTO 1920
1820 INPUT D1$
1830 IF LEFT$(D1$,1)="G" THEN 1900
1840 IF LEFT$(D1$,1)="H" THEN 1750
1850 PRINT"     RETYPE: ";:GOTO 1820
1870 B1=2*B
1880 GOSUB 2940
1890 IF T1=0 THEN 1770
1900 PRINT:PRINT T1
1910 X1=T1
1920 PRINT"SECOND HAND"
1930 B2=B
1940 PRINTV$(X)
1950 T1=X
1960 GOSUB 2940
1970 IFX<>1 THEN 2000
1980 T1=T1+10
1990 GOTO 2230
2000 INPUT D1$
2010 IF LEFT$(D1$,1)="G"THEN 2230
2020 IF LEFT$(D1$,1)="D" THEN 2200
2030 IF LEFT$(D1$,1)="H" THEN 2060
2040 PRINT "     RETYPE: ";:GOTO 2000
2060 GOSUB 2940
2070 IF T1>0 THEN 2150
2080 X2=0
2090 C=C-B2
2100 B2=0
2110 PRINT"BUST";
2120 IF X1>0 THEN 2410
2130 PRINT "     ";V$(H)
2140 GOTO 2510
2150 INPUT D1$
2160 IF LEFT$(D1$,1)="G" THEN 2230
2170 IF LEFT$(D1$,1)="H"THEN 2060
2180 PRINT "     RETYPE: ";:GOTO 2150
2190 B2=2*B
2200 GOSUB 2940
2210 IF T1=0 THEN 2080
2230 PRINT:PRINTT1
2240 B=B1+B2
2250 X2=T1
2260 GOTO 2410
2270 GOSUB 2940
2280 IF T1>0 THEN 2320
2290 PRINT"BUST";
2300 PRINT"     ";V$(H)
2310 GOTO 2560
2320 INPUT D$
2330 IF LEFT$(D$,1)="G" THEN 2400
2340 IF LEFT$(D$,1)="H" THEN 2270
2350 PRINT "     RETYPE: ";:GOTO 2320
2370 B=2*B
2380 GOSUB 2940
2390 IF T1=0 THEN 2290

2400 PRINT:PRINTT1;
2410 PRINT"     ";V$(H);
2420 GOTO 2450
2430 GOSUB 3090
2440 PRINT"  ";V$(C(L-1));
2450 IF T<17 THEN 2430
2460 IF T>21 THEN 2490
2470 PRINT":";T
2480 GOTO 2530
2490 PRINT": BUST"
2500 C=C+B
2510 PRINT"YOU HAVE $";C
2520 GOTO 1250
2530 IF LEFT$(D$,1)="S" THEN 2580
2540 IF T1>T THEN 2500
2550 IF T1=T THEN 2510
2560 B=-B
2570 GOTO 2500
2580 IF T>X1 THEN 2670
2590 IF T=X1 THEN 2610
2600 C=C+B1
2610 IF T>X2 THEN 2650
2620 IF T=X2 THEN 2510
2630 C=C+B2
2640 GOTO 2510
2650 C=C-B2
2660 GOTO 2510
2670 C=C-B1
2680 GOTO 2610
2690 IF T1=21 THEN 2740
2700 C=C-B
2710 PRINT"     ";V$(H);
2720 PRINT"  BLACKJACK"
2730 GOTO 2510
2740 PRINT"BLACKJACK"
2750 PRINT "     ";
2760 GOTO 2710
2770 PRINT"BLACKJACK"
2780 PRINT"     ";V$(H);
2790 PRINT
2800 C=C+1.5*B
2810 GOTO 2510
2820 INPUT"     INSURANCE ";I$
2840 IF LEFT$(I$,1)="Y" THEN 2870
2850 PRINT "     ";
2860 GOTO 1500
2870 IF T=21 THEN 2900
2880 C=C-.5*B
2890 GOTO 2850
2900 PRINT "     10";
2910 IF T1<>21 THEN 2720
2920 C=C+B
2930 GOTO 2720
2940 IF T1>10 THEN 2980
2950 IF C(L)<>1 THEN 2980
2960 T1=T1+10
2970 S1=1
2980 T1=T1+C(L)
2990 PRINT V$(C(L));"  ";
3000 L=L+1
3010 IF T1<=21 THEN 3080
3020 IF S1=0 THEN 3060
3030 T1=T1-10
3040 S1=0
3050 GOTO 3080
3060 T1=0
```

```
3070 PRINT
3080 RETURN
3090 IF T>10 THEN 3130
3100 IF C(L)<>1 THEN 3130
3110 T=T+10
3120 S=1
3130 T=T+C(L)
3140 L=L+1
3150 IF T<=21 THEN 3190
3160 IF S=0 THEN 3190
3170 T=T-10
3180 S=0
3190 RETURN
3310 PRINT"THIS BLACKJACK PROGRAM ENABLES THE OPERATOR TO PLAY HEAD-"
3320 PRINT"TO-HEAD WITH THE COMPUTER, SIMULATING THE EXACT RULES AS"
3330 PRINT"THOSE ON THE LAS VAGES STRIP.  THE CARDS ARE DEALT FROM ONE"
3340 PRINT"52-CARD DECK UNTIL A HAND STARTS WITH LESS THAN 12 CARDS"
3350 PRINT"REMAINING IN WHICH CASE IT RESHUFFLES.  THE DEALER MUST HIT"
3360 PRINT"THROUGH A TOTAL OF 16 AND STAND ON ALL TOTALS OF 17 AND ABOVE
"
3370 PRINT:PRINT"THE INSURANCE BET IS OFFERED AT HALF THE PLAYERS BET WH
EN"
3380 PRINT"THE DEALER'S UP-CARD IS AN ACE. "
3390 PRINT"YOU MAY,DOUBLE-DOWN ON ANY TWO CARDS, AND RECIEVE ONE MORE"
3395 PRINT"CARD WHILE THE ORIGINAL BET IS DOUBLED"
3400 PRINT"YOU MAY SPLIT ANY HAND BUT RESPLITTING IS NOT ALLOWED. "
3410 PRINT"ALSO, ONLY ONE CARD IS DELT ON EACH OF A PAIR OF ACES. "
3415 PRINT"YOUR CARDS APPEAR IN THE FAR LEFT COLUMN; THE DEALER ON THE"
3420 PRINT"FAR RIGHT.  "
3430 PRINT" THE COMMANDS ARE AS FOLLOWS: "
3440 PRINT"      HIT (DRAW ANOTHER CARD)"
3450 PRINT"      GOOD (STAND ON CURRENT TOTAL)"
3460 PRINT"      DOUBLE (DOUBLE YOUR BET AND DRAW ONE CARD)"
3470 PRINT"      SPLIT (FORM TWO HANDS FROM A PAIR WITH THE ORIGINAL"
3480 PRINT"             BET ON EACH HAND)"
3490 PRINT:PRINT"COMMANDS MAY BE TYPED IN AS THE FIRST LETTER":PRINT"GOO
D LUCK"
3500 GOTO 1040
OK
```

NOTABLES

8080 ADDRESS COMPARISON SUBROUTINE

Often, in the course of writing assembly language programs, it becomes necessary to compare two addresses, and build into the program certain logic based on the results of that comparison. Because the addresses are 16 bit data no one or two instructions will do the job. The following routines, however, will accomplish the task with minimum memory requirement.

In the main line (or calling routine) load the H & L with one of the addresses to be compared:

```
LHLD  ADDR1
XCHG
```

Then load H & L with the pointer to the other address, and call the subroutine:

```
LXI   H,ADDR2+1
CALL  ADCK
```

Then

In the subroutine, first compare the high order. If a difference is found, the low order need not be compared, so a return is made on a minus condition:

```
ADCK: MOV A,M
      CPA D
      RC
      DCX H
      MOV A,M
      CPA E
      RET
```

If ADDR1 is equal or less than ADDR2, the carry bit will not be set, and a subsequent decision may be made on its state. Or the decision could be based on the state of the zero bit if only an equal condition were sought.

Should the logic of the program demand to know if ADDR2 were equal to or less than ADDR1, simply put ADDR2 in the D & E registers, and the ADDR1 pointer in the H & L. Or, write the subroutine as follows:

```
ADCK: MOV A,D
      CPA M
      RC
      DCX H
      MOV A,E
      CPA M
      RET
```

The same technique may be used for comparing 16 bit values basing decisions on the carry bit rather than the sign bit.

Minor Front Panel Additions to the Altair 8800

By Richard R. Kenyon

During console debugging of programs, it is frequently necessary to display the status of the "flag" bits in the data lights, D0 to D7. It was found convenient to mark the names of these flag bits over the lights using 1/8 in. dry transfer letters. The gray panel was found too smooth for the letters to adhere, so the letters were put on the edge of the blue frame. Clear lacquer was sprayed over the lettering to protect it. The actual lettering used was as follows (reading from left to right):

S Z O AC O PE 1 C

The meanings of these are:

S = Sign Flag
Z = Zero Flag
0 = A flag bit that is always zero
1 = A flag bit that is always one
AC = Auxiliary Carry Flag (BCD arithmetic)
PE = Even Parity Flag
C = Carry Flag

Another simple modification was made to the panel to facilitate hexadecimal notation. Using 1/16″ black scotch tape (obtained from any office supply store), 3 vertical strips were placed between each group of four lights and switches. In order to reduce errors with hexadecimal codes above 9, the following little table was typed up and stuck between the panel and its frame where, of course, the X's represent lights that are lit.

```
A X0X0
B X0XX
C XX00
D XX0X
E XXX0
F XXXX
```

IMSAI 8080 vectored from . . . pg. 60

VALUED JUDGMENTS

IMSAI was *very* prompt in providing the kit buyer with errata when they discovered that one unit or another needed corrections. In addition, on certain rather complicated modifications, IMSAI offered to make the modifications themselves, if the kit builder did not trust himself to fix the unit. IMSAI has also been quite helpful and is forthcoming with software for various units of the equipment, supplying it on paper tape and in hexadecimal source listings.

With the assistance of my friends in checking out the IMSAI 8080, we conclude that this equipment is well designed, sturdy, and easily capable of expansion to the full limits of addressable memory. IMSAI has acted in a very businesslike fashion, in my experience with them, and have tried to be genuinely helpful to their customers.

Recently IMSAI raised basic equipment prices, without memory, to $599, and some have complained strongly. It may be that the complainers are not in this hobby with the same objectives I have. Certainly I consider in view of the high quality of the merchandise, the IMSAI equipment is worth the premium price to anyone who has never attempted to build an electronics kit before. Anyone who considers the IMSAI not worth the price should consider, after inspecting one, whether he could duplicate the system with resources available to him. If he could match the high quality provided, could he deliver the goods to others at the price? If so, why isn't he in there competing?

On the other hand, it must be understood that the IMSAI is not a minimum system, but is designed with an enclosure and power supply for building the maximum possible system on the Intel 8080 bus. An experimenter who is trying to assemble a "hobby" system may well wish to start with another unit. But if he is looking for a complete system with a minimum of hardware hassles and a maximum of service support, the IMSAI is highly recommended. ◻

FIFO FLEA MARKET

1800 COSMAC—Interested or working with this for microcomputer or control? Contact: Louis G. Fields, 11662 Sunset Blvd. Suite 2, Los Angeles, CA 90049. (213) 472-0388 or (213) 272-0942.

CAN YOUR COMPUTER TALK? Does it understand what you say? If so, let me know what I need. I'm looking for low-cost hardware and software that could be used for computer speech synthesis and/or voice recognition. Contact: B. W. Klatt, R.R. 1, Oliver, B.C., Canada. VOH 1TO.

IBM INFORMANT WANTED!!! What Yard is IBM currently using to demolish their used 2741's selectromatic terminals. Reward for info leading to recovery before compactor. Or . . . if the great God of all that is computers would recognize a non-compatible, I'll buy. IBM call SWEET MARY (213) 472-1098, collect.

WANTED Manual for electronics of Model 9350-2 Communicating Typewriter, purchased through Herbach & Rademan. If anyone is in contact with Herbach & Rademan, Burroughs, Friden, or agency of the U.S. Dept. of Defense that has manual, HELP! Need info on how to make three of these units operate to their full capabilities. S. A. Cochran, Jr. P.O. Box 607, Tyler, Tex. 75701.

FOR SALE, MODEM, Singer Tele-Data Model 883A, 0-300 baud. Computer side RS-232-B or CCITT V.24. Line side compatible to AT&T 103 Series, Full Duplex. 2-wire. Sync. or Async. Instruction Book, Cables. Like New. Herbert A. Lyon, 2520 Vernon Drive, Greenville, Texas 75401, (214) 455-9225.

FOR SALE: CRT's and ASR 33 TTYs, $500-750. All sorts of peripheral equipment: PTPNR, line printers, disk drives, and card readers. Write or phone for a list with prices. Contact: Bob Sternberg, 1557 West Ball Rd., Apt. A, Anaheim, CA 92802. (714) 635-4759.

POWER SUPPLIES, Large/small; W/wrap logic panels (180 + IC soc's) $15; 40 cond ribbon cable, 4 to 8 ft, $1/ft; W/wrap proto bds (edge con/IC soc's, not Altair style); Other misc. Call Bob O'Brien (213) 320-5089, Torrance, or Al (213) 926-0942, Baldwin Park, EVENINGS.

FOR SALE: TVT 2 with serial I/O board and case. TV available also. Call Art Childs (213) 243-5179.

WANTED: Manual, Schematic, and/or Service Data for BURROUGHS Model 9350-2 Communications Terminal—Automatic Typewriter. M.D. Cassetti, 1011 Devonport Ln., Seabrook, Tx. 77586.

IMSAI PIO 4-4 Four Port parallel board assembled with ribbon cable and connectors at kit price. Contact Bill Roch, 24365 Clipstone St., Woodland Hills, CA 91364. (213) 348-4278, evenings.

CONFUSED: Need available application software information on which to base computer acquisition (8080, 6800 or whatever) CAI, bookkeeping, inventory, etc. Willing to pay within reason. Leo C. White, 418 So. Lincoln, Port Angeles, Wa. 98362. (206) 457-3315.

FOR SALE: IMSAI 8080. Assembled and tested by professional E.E. 22 slot motherboard and all software rights. (RAM, etc. also available.) $850 or offer. (Reg. price $983 + handling and tax.) Also, one in box: $600. (Reg. price $651 + handling and tax.) Swap for CRT terminal or other goodies. Contact: Richard Lyon, 265 W. Portola Ave., Los Altos, Ca. 94022. (415) 941-8159.

WANTED: Automatic card reader for demonstration project in the New York City Public School System. Please call (212) 852-2957, or write Alex Aderer, 166 Bergen St., Brooklyn, NY 11217.

FIFO FLEA MARKET AD RATE: $2.00 per column line (40 characters). Max 10 lines per ad. Submit Ads to FIFO Ads—INTERFACE Magazine, P.O. Box 1234, Cerritos, CA 90701. Payment must accompany ad.

CONFUSED!! Need available application software information on which to base computer acquisition (8080, 6800 or whatever), CAI, bookkeeping, inventory, etc. Willing to pay within reason. Leo C. White, 418 So. Lincoln, Port Angeles, WA 98362. (206) 457-3315.

BRAND NEW! 33 ASR Teletype, Auto paper tape reader. $1088. Immediate delivery! J. Katz (213) 474-3347.

FOR SALE—NEW completely assembled IMSAI 8080 system. Includes 12K RAM, 2 serial I/O ports, cassette interface, eight levels of priority interrupts, and clock board. Will sell to highest bid over $2,425. J. Whitney, 2405 Haisley, Ann Arbor, MI. 48103. (313) 662-2530.

WANTED: 6800 BASIC SOURCE listing or paper tape. I need source to make mods for funny machine I have. Will pay reasonable price for your effort. W. Bringier, 350 The Village #116, Redondo Beach, CA 90277. (213) 374-5170.

INTERFACIAL vectored from . . . 62

the programming novice to BASIC, in Bruce A. Scott's "BASIC, An Easy Programming Language." Another kind of novice, S. A. Cochran, was a stranger to hardware assembly. At least until he started putting together his IMSAI. With the inexperienced in mind, Sid Cochran gives us a look at assembling the IMSAI 8080.

SYSTEMS vectored from . . . page 74

yet doing the access in ASCII.

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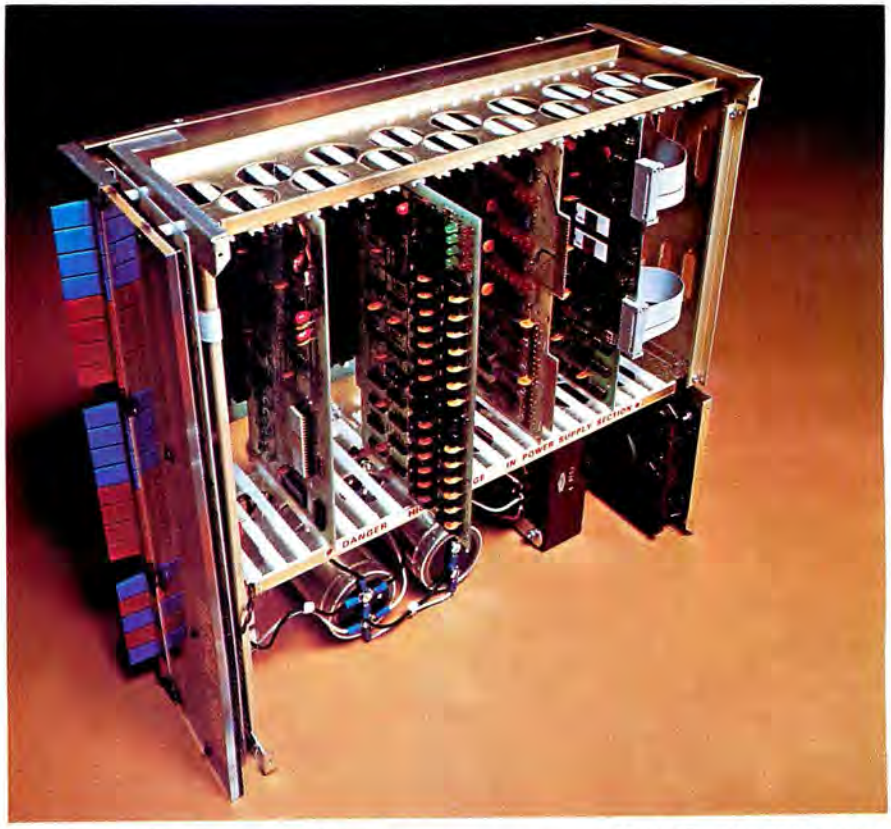

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